

DTIC 5-3810-289-10

DEPARTMENT OF THE ARMY TECHNICAL MA

TM 5-3810-289-

OPERATOR AND ORGANIZATIONAL MAINTENAN

MANUAL

**CRANE-SHOVEL, CRAWLER MOUNTED
121/2-TON, 3/4-CU YD, DIESEL ENGINE
DRIVEN (BUCCYRUS-ERIE MODEL 22BM)
FSN 3810-869-3092**

This copy is a reprint which includes current
pages from Change. 1

WARNING

EXPLOSION AND FIRE HAZARD

is present when servicing batteries and filling fuel tank.

DEATH

or severe injury may result if personnel fail to observe safety precautions. Do not smoke or use open flame around flammable material or when servicing the batteries.

Do not fill the fuel tank while the engine is running. Be sure there are no open flames or exposed heated parts that can ignite fuel vapors while tank is being filled. Keep fuel container and funnel in contact while tank is being filled, or provide a ground to prevent static sparks from igniting the fuel.

Do not attempt to weld a fuel tank unless the tank has been filled with water and thoroughly flushed to eliminate combustible fuel vapors.

HIGH VOLTAGE HAZARD

is present if the boom accidentally contacts a power line.

DEATH

or severe injury may result if personnel fail to observe safety precautions.

Keep the boom away from power lines. If the boom accidentally contacts a power line, jump from the machine; do not step off.

Operator and Organizational Maintenance Manual

for

**CRANE-SHOVEL, CRAWLER MOUNTED, 12 1/2-TON,
3/4-CU YD; DIESEL ENGINE DRIVEN (BUCYRUS-ERIE MODEL 22 BM)
FSN 3810-869-3092**

TM 5-3810-289-12, 13 March 1970, is changed as follows:

Page 1-1. Paragraph 1-3 is superseded as follows:

1-3. Reporting of Equipment Publication Improvements

The reporting of errors omissions and recommendations for improving this bulletin by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publica-

tions) and forward direct to Commander, US Army Troop Support Command, ATTN: AMSTS-MPP, 4300 Goodfellow Boulevard, St. Louis, Missouri 63120. A reply will be furnished directly to you.

Page 2-7. Paragraph 2-3d is added as follows:

d. *Maintenance and Operating Supplies.* Refer to table 2-1 for a list of maintenance and operating supplies necessary for initial operation of this equipment.

Table 2-1. Maintenance and Operating Supplies

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required F/initial operation	(5) Quantity required F/8 hrs operation	(6) Notes
CHAIN CASE	9150-265-9435 (2) 9150-265-9428 (2) 9150-242-7603 (2)	OIL, LUBRICATING: 5-gal drum as follows: OE 30 OE 10 OES	3 qt 3 qt 3 qt	(3) (3) (3)	(1) Includes quantity of oil to fill engine oil system as follows: 20 qt — crankcase w/filters
CRANKCASE	9150-265-9435 (2) 9150-265-9428 (2) 9150-242-7603 (2)	OIL, LUBRICATING: 5-gal drum as follows: OE 30 OE 10 OES	20 qt 20 qt 20 qt	(3) (3) (3)	(2) See C9100-IL for additional data and requisitioning procedures. (3) See current LO for grade application and replenishment intervals.
GEARCASE, MAIN	9150-577-5844 (2) 9150-259-5440 (2)	OIL, LUBRICATING, GEAR: 5-gal drum as follows: GO 90 GOS	32 qt 32 qt	(3) (3)	(4) Average fuel consumption is 2.3 gal per hour of continuous operation.
GEARCASE, CRAWLER	9150-577-5844 (2) 9150-254-5440 (2)	OIL, LUBRICATING, GEAR: gal drum as follows: GO 90 GOS	2 qt 2 qt	(3) (3)	(5) Maximum protection is obtained at 60 percent by volume (4.8 pt per gal of solution).

application	stock number		required F/initial operation	required F/8 hrs operation	
GEARS, EXPOSED		OIL, LUBRICATING, EX- POSED GEAR: 5-gal can as follows:			
	9150-234-5199 (2)	CW-11-B	5 lb	(3)	
GREASE POINTS		GREASE, AUTOMOTIVE AND ARTILLERY: 5-lb can as follows:			
	9150-190-0905	GAA	5 lb	(3)	
OIL CAN POINTS		OIL, LUBRICATING: 5-gal drum as follows:			
	9150-265-9435 (2)	OE 30	1 qt	(3)	
	9150-265-9428 (2)	OE 10	1 qt	(3)	
	9150-242-7603 (2)	OES	1 qt	(3)	
RADIATOR		WATER ANTIFREEZE: 1-gal can as follows:	28 qt		
	6850-664-1403	Ethylene-glycol	18 qt	(5)	
		ANTIFREEZE: 55-gal drum as follows:			
	6850-174-1806	Antifreeze, arctic	28 qt		
TAG LINE		OIL, LUBRICATING, GEAR: 5-gal drum as follows:			
	9150-577-5844 (2)	GO-90	4 qt	(3)	
TANK, FUEL		FUEL, DIESEL: Bulk as follows:			
	9140-286-5294 (2)	DF-2 Regular	50 gal	(4)	
	9140-286-5286 (2)	DF-1 Winter	50 gal	(4)	
	9150-286-5283 (2)	DF-A Arctic	50 gal	(4)	

4-7, paragraph 4-13b. In line 1, change "60/70"
"25/30".

4-32. Paragraph 4-35b.1 is added as follows:

1. On-Equipment Troubleshooting.

(1) Remove the alternator terminal cover to
expose the positive output terminal, and using a volt-
meter, check the voltage between this terminal and
ground. The ignition switch should be on when this
check is made. Full battery voltage should be
indicated. If no voltage is indicated between the
positive alternator terminal and ground, an open cir-
cuit between the positive alternator and battery is
indicated. This may be due to loose or broken

wiring, or possibly a defective ignition switch, cir-
cuit breaker or ammeter.

(2) Full battery voltage must be present at both
alternator terminals in order for the vehicle to func-
tion properly.

(3) Do not, under any circumstances, attempt to
run the alternator with its output circuit open and
its ignition lead energized. This will create
extremely high voltages which will seriously damage
the alternator.

(4) The high-low top is not adjustable and
should not be changed. If batteries show indication

of over or under charging, adjustment should be made in the following manner.

(a) Connect voltmeter across positive and negative terminals of the battery.

(b) Start engine and run at 1000-1500 RPM. Do not turn on external loads such as lights, heaters, etc.

(c) Voltmeter should read 28.0 volts. If the reading is above or below this figure, voltage should be adjusted.

(d) Remove socket head pipe plug from drive end housing to gain access to voltage adjustment screw.

(e) Using a small screwdriver, turn the adjusting screw until 28.0 volts is indicated on the voltmeter. Turn screw counterclockwise to increase voltage and clockwise to decrease.

(f) After adjustment, replace plug.

Page C-1. Appendix C is superseded as follows:

APPENDIX C

BASIC ISSUE ITEM LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED

Section I. INTRODUCTION

C-1. Scope

This appendix lists basic issue items, items troop installed or authorized which accompany the crane-shovel, and are required by the crew/operator for operation, installation, or operator's maintenance.

C-2. General

This basic issue items, items troop installed or authorized list is divided into the following sections:

a. Basic Issue Items List-Section II. Not applicable.

b. Items Troop Installed or Authorized List - Section III. A list in alphabetical sequence of items which at the discretion of the unit commander may accompany the end item, but are NOT subject to be turned in with the end item.

C-3. Explanation of Columns

The following provides an explanation of columns in

the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

a. Source, Maintenance, and Recoverability Code(s) (SMR): Not applicable.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (UIM). A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Authorized (Items Troop Installed or Authorized Only). This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR Code	(2) Federal stock number	(3) Description Ref No. & Code Usable on Code	(4) Unit of Meas	(5) Qty Auth
	7520-559-9618	CASE, Maintenance and Operating Manual	EA	1
	2590-045-9611	CASE, Rifle	EA	1
	4210-889-2221	EXTINGUISHER, Fire	EA	1

al:
ERNE L. BOWERS
Major General, United States Army
e Adjutant General

Chief of Staff

tribution:

To be distributed in accordance with DA Form 12-25B (qty rqr block No. 921) operator maintenance
irements for Crane Shovel, Crawler, 10-20 Ton.

**OPERATOR AND ORGANIZATIONAL MAINTENANCE
MANUAL
CRANE-SHOVEL, CRAWLER MOUNTED; 12½-TON,
¾-CU YD; DIESEL ENGINE DRIVEN
(BUCYRUS-ERIE MODEL 22BM)
FSN 3810-869-3092**

List of Illustrations

		Paragraph	Page
CHAPTER	1. INTRODUCTION		
Section	I. General	1-1 — 1-3	1-1
	II. Description and data	1-4 — 1-6	1-1 — 1-6
CHAPTER	2. OPERATING INSTRUCTIONS		
Section	I. Service upon receipt of materiel	2-1 — 2-9	2-1 — 2-20
	II. Movement to new worksite	2-10, 2-11	2-28
	III. Controls and instruments	2-12, 2-13	2-31
	IV. Operation under usual conditions	2-14 — 2-22	2-39 — 2-55
	V. Operation under unusual conditions	2-23 — 2-27	2-58 — 2-59
CHAPTER	3. OPERATOR'S MAINTENANCE INSTRUCTIONS		
Section	I. Basic issue items	3-1, 3-2	3-1
	II. Lubrication instructions	3-3, 3-4	3-1
	III. Preventive maintenance checks and services	3-5, 3-6	3-3
	IV. Troubleshooting	3-7, 3-8	3-6
	V. Maintenance of engine clutch assembly, release mechanism control levers and turntable swinglock	3-9 — 3-12	3-7
	VI. Maintenance of fuel system components	3-13, 3-14	3-12
	VII. Maintenance of engine cooling system components	3-15, 3-16	3-15
	VIII. Maintenance of electrical system components	3-17, 3-18	3-16
	IX. Maintenance of transmission assembly	3-19	3-18
	X. Maintenance of wheels and tracks	3-20 — 3-22	3-18
	XI. Maintenance of cab components	3-23, 3-24	3-22
	XII. Maintenance of crane, shovel, and earthmoving equipment components	3-25 — 3-37	3-24 — 3-30
CHAPTER	4. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS		
Section	I. Repair parts, special tools, and equipment	4-1 — 4-3	4-1
	II. Preventive maintenance checks and services	4-4, 4-5	4-1
	III. Troubleshooting	4-6, 4-7	4-1
	IV. Radio interference suppression	4-8 — 4-11	4-3
	V. Maintenance of engine cylinder head and valve mechanism	4-12, 4-13	4-3 — 4-7
	VI. Maintenance of engine oil cooler and oil filter assembly, and main clutch adjustment	4-14 — 4-16	4-7
	VII. Maintenance of clutch release mechanism control levers, and turntable swing lock	4-17, 4-18	4-10
	VIII. Maintenance of engine fuel system components	4-19 — 4-27	4-12
	IX. Maintenance of engine exhaust system components	4-28 — 4-30	4-22

* This manual supersedes Operator and Organizational maintenance portion of TM 5-3810-289-15, 3 July 1968.

	XI. Maintenance of electrical system components	4-48-4-48	4-52-4-52
	XII. Maintenance of transmission assembly, wheels and track components	4-47-4-50	4-44
	XIII. Maintenance of cab components	4-51-4-52	4-49
	XIV. Maintenance of crane boom assembly, dragline, and clamshell front end equipment	4-53-4-61	4-53-4-63
	XV. Maintenance of clutch and brake assemblies	4-62-4-64	4-68
	XVI. Maintenance of chain case assembly, cone rollers, and gear case covers	4-65-4-67	4-71
	XVII. Maintenance of shovel front end equipment	4-68-4-73	4-77-4-79
	XVIII. Maintenance of backhoe front end equipment	4-74-4-79	4-79-4-81
PENDIX	A. REFERENCES	A-1-A-7	A-1
	B. MAINTENANCE ALLOCATION CHART	B-1-B-4	B-1-B-2
	C. BASIC ISSUE ITEMS LIST	C-1-C-4	C-1-C-2
DEX			I-1

1-1	Right front view of model 22BM crane-shovel	1-2
1-2	Left rear view of model 22BM crane-shovel	1-3
1-3	Crane boom angle chart	1-7
1-4	Electrical system, schematic diagram (sheet 1 of 2)	1-8
1-4	Electrical system, schematic diagram (sheet 2 of 2)	1-9
2-1	Battery cable connections	2-2
2-2	Installation of counterweight and boom angle indicator (sheet 1 of 2)	2-3
2-2	Installation of counterweight and boom angle indicator (sheet 2 of 2)	2-4
2-3	Operating levers	2-5
2-4	Operating pedals	2-6
2-5	Crowd clutch linkage	2-6
2-6	Forward brakeband	2-7
2-7	Jib boom cable reeving diagram	2-8
2-8	Dragline and clamshell front end attachment	2-9
2-9	Backhoe and shovel front end attachment	2-9
2-10	Dragline fairlead, removal and installation	2-10
2-11	Dragline cable reeving	2-11
2-12	Drag chain clevis, removal and installation	2-12
2-13	Tagline unit, removal and installation	2-12
2-14	Clamshell cable reeving	2-13
2-15	Backhoe boom support cribbing	2-14
2-16	Backhoe cable reeving	2-15
2-17	Roller and spacer arrangement	2-16
2-18	Roller assembly, shaft and spacers	2-17
2-19	Crowd chain sprocket, removal and installation	2-18
2-20	Shovel components	2-19
2-21	Crowd chain adjusting bracket	2-20
2-22	Shovel boom support cribbing	2-20
2-23	Shovel cable reeving	2-21
2-24	Dipper trip cable reeving	2-22
2-25	Dipper trip clutch adjustment	2-22
2-26	Dipper adjustment	2-23
2-27	Backhaul cable adjustment	2-24
2-28	Saddle block wearing plate adjustment	2-24
2-29	Piledriver, assembly and disassembly (sheet 1 of 3)	2-25
2-29	Piledriver, assembly and disassembly (sheet 2 of 3)	2-26
2-29	Piledriver, assembly and disassembly (sheet 3 of 3)	2-27
2-30	Crane-shovel mounted on trailer	2-29
2-31	Counterweight blocking	2-30
2-32	Engine controls and instruments (sheet 1 of 2)	2-32
2-32	Engine controls and instruments (sheet 2 of 2)	2-33
2-33	Operating controls	2-34
2-34	Dragline operating controls	2-35
2-35	Clamshell operating controls	2-36
2-36	Backhoe operating controls	2-37
2-37	Shovel operating controls	2-38
2-38	Starting the engine (sheet 1 of 2)	2-40
2-38	Starting the engine (sheet 2 of 2)	2-41
2-39	Stopping the engine	2-42
2-40	Operating the crane-shovel, spotting operation (sheet 1 of 2)	2-43
2-40	Operating the crane-shovel, spotting operation (sheet 2 of 2)	2-44
2-41	Operating the crane-shovel, hoisting and lowering operation (sheet 1 of 2)	2-45
2-41	Operating the crane-shovel, hoisting and lowering operation (sheet 2 of 2)	2-46
2-42	Operating the crane-shovel, swinging operation (sheet 1 of 2)	2-47
2-42	Operating the crane-shovel, swinging operation (sheet 2 of 2)	2-48
2-43	Operating the crane-shovel, propelling	2-49
2-44	Operating the crane-shovel, steering	2-50
2-45	Operating the dragline (sheet 1 of 2)	2-51
2-45	Operating the dragline (sheet 2 of 2)	2-52
2-46	Operating the clamshell (sheet 1 of 2)	2-53
2-46	Operating the clamshell (sheet 2 of 2)	2-54
2-47	Operating the backhoe (sheet 1 of 2)	2-54

2-48	Operating the shovel (sheet 1 of 2)	2-56
2-48	Operating the shovel (sheet 2 of 2)	2-57
3-1	Oil filter service	3-2
3-2	Engine clutch assembly	3-8
3-3	Engine clutch assembly inspection	3-9
3-4	Control levers	3-10
3-5	Swing lock adjustment	3-11
3-6	Air cleaner service	3-13
3-7	Fuel tank and cap, service and replacement	3-14
3-8	Belt adjustment	3-15
3-9	Alternator belt	3-17
3-10	Track idler service (inner side view)	3-19
3-11	Track idler service (outer side view)	3-20
3-12	Track belt and roller chain adjustment	3-21
3-13	Seat assembly adjustment	3-23
3-14	Boom assembly inspection	3-25
3-15	Operating clutch inspection	3-26
3-16	Operating clutch adjustment	3-27
3-17	Steering clutches adjustment	3-28
3-18	Boom hoist brakeband adjustment	3-29
3-19	Digging lock	3-31
4-1	Valve cover replacement	4-4
4-2	Rocker arm adjustment (tappet clearance)	4-5
4-3	Rocker arm adjustment (locknut torque)	4-6
4-4	Oil cooler, removal and installation	4-8
4-5	Oil cooler disassembly	4-9
4-6	Swing lock replacement	4-11
4-7	Fuel pump filter screen service	4-13
4-8	Fuel lines and fittings replacement	4-14
4-9	Fuel lines and fittings	4-15
4-10	Fuel inlet and drain connection	4-16
4-11	Shutdown valve replacement	4-17
4-12	Air cleaner replacement	4-18
4-13	Fuel filter replacement	4-19
4-14	Primer assembly service and replacement	4-20
4-15	Throttle control assembly	4-21
4-16	Air intake manifold replacement	4-23
4-17	Muffler and exhaust pipe replacement	4-24
4-18	Exhaust manifold replacement	4-25
4-19	Radiator, service and replacement	4-27
4-20	Belt adjustment	4-28
4-21	Thermostat testing	4-29
4-22	Thermostat and thermostat housing replacement	4-30
4-23	Fan blade replacement	4-31
4-24	Alternator test connection (sheet 1 of 2)	4-33
4-24	Alternator test connection (sheet 2 of 2)	4-34
4-25	Alternator replacement	4-35
4-26	Starting motor, internal wiring diagram	4-36
4-27	Starting motor, removal and installation	4-37
4-28	Solenoid testing	4-38
4-29	Solenoid replacement	4-39
4-30	Engine safety control replacement	4-40
4-31	Horns, lights and control panel	4-41
4-32	Battery and battery cable replacement	4-43
4-33	Transmission shaft	4-45
4-34	Upper track support rollers	4-46
4-35	Lower track support rollers	4-47
4-36	Track belt, removal and installation	4-48
4-37	Cab assembly	4-50
4-38	Seat assembly, removal and installation	4-52
4-39	Reeving boom suspension cable	4-54
4-40	Reeving crane hoist cable	4-55
4-41	Boom point sheaves	4-56
4-42	Boom, removal	4-57

4-43	Splice bolts	4-63
4-44	Boom assembly, exploded view	4-60
4-45	Dragline bucket, disassembly and reassembly	4-62
4-46	Dragline fairlead, disassembly and reassembly	4-63
4-47	Clamshell bucket, disassembly and reassembly	4-64
4-48	Boom cribbing method	4-65
4-49	Jib boom assembly, exploded view	4-66
4-50	Jib boom mast assembly, exploded view	4-67
4-51	Clutch and brakebands, removal and installation (Sheet 1 of 2)	4-69
4-51	Clutch and brakebands, removal and installation (sheet 2 of 2)	4-70
4-52	Gear case sump	4-72
4-53	Cone roller replacement	4-73
4-54	Front frame cover	4-74
4-55	Rear frame cover	4-75
4-56	Bevel gear case cover	4-76
4-57	Shovel dipper assembly, removal and installation	4-77
4-58	Saddle block, disassembly and reassembly	4-78
4-59	Backhoe dipper assembly, exploded view	4-80
4-60	Backhoe handle and pitch brace assembly, exploded view	4-81
4-61	Backhoe A-frame assembly, exploded view	4-82
4-62	Backhoe boom assembly, exploded view	4-83

Section I. GENERAL

1-1. Scope

a. This manual contains instructions for use by personnel to whom model 22BM crane-shovel is issued. It provides information on operation, preventive maintenance checks and services, and maintenance and repair of equipment, accessories, components, and attachments. Also included are descriptions of main units and their functions in relationship to other components. Numbers in parentheses following nomenclature callouts on illustrations indicate quantity; numbers preceding nomenclature callouts indicate preferred sequence.

b. Instructions for Administrative Storage and Destruction of Materiel to Prevent Enemy Use are contained in the following technical manuals:

TM 740-90-1 Administrative Storage of
Equipment

TM 750-244-3 Destruction of Materiel to
Prevent Enemy Use

1-2. Maintenance Forms and Records

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Reporting of Errors

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

Section II. DESCRIPTION AND DATA

1-4. Description

a. *General.* The model 22BM crane-shovel (fig. 1-1 and 1-2) is a crawler-mounted lifting crane which can be converted to a dragline, clamshell, backhoe, shovel, or piledriver. The lifting crane consists of a 30-ft, two-section boom, a 12½-ton capacity hook block, and associated cables. The boom can be lengthened by the addition of sections between the upper and lower boom sections. In addition, a jib can be added to the end of the upper boom assembly. The lifting crane can be used for unloading heavy cargo, placing steel beams in construction work, and other heavy lifting jobs. Load control afforded by the regular hoist line is supplemented by an independent boom hoist. Full power control of both raising and lowering the boom permits accurate spotting of the load in the horizontal as well as the vertical plane.

b. *Basic Crane-Shovel.* The basic crane-shovel is divided into three sections: the front end equipment, the upper works, and the lower works.

(1) The front end equipment consists of the

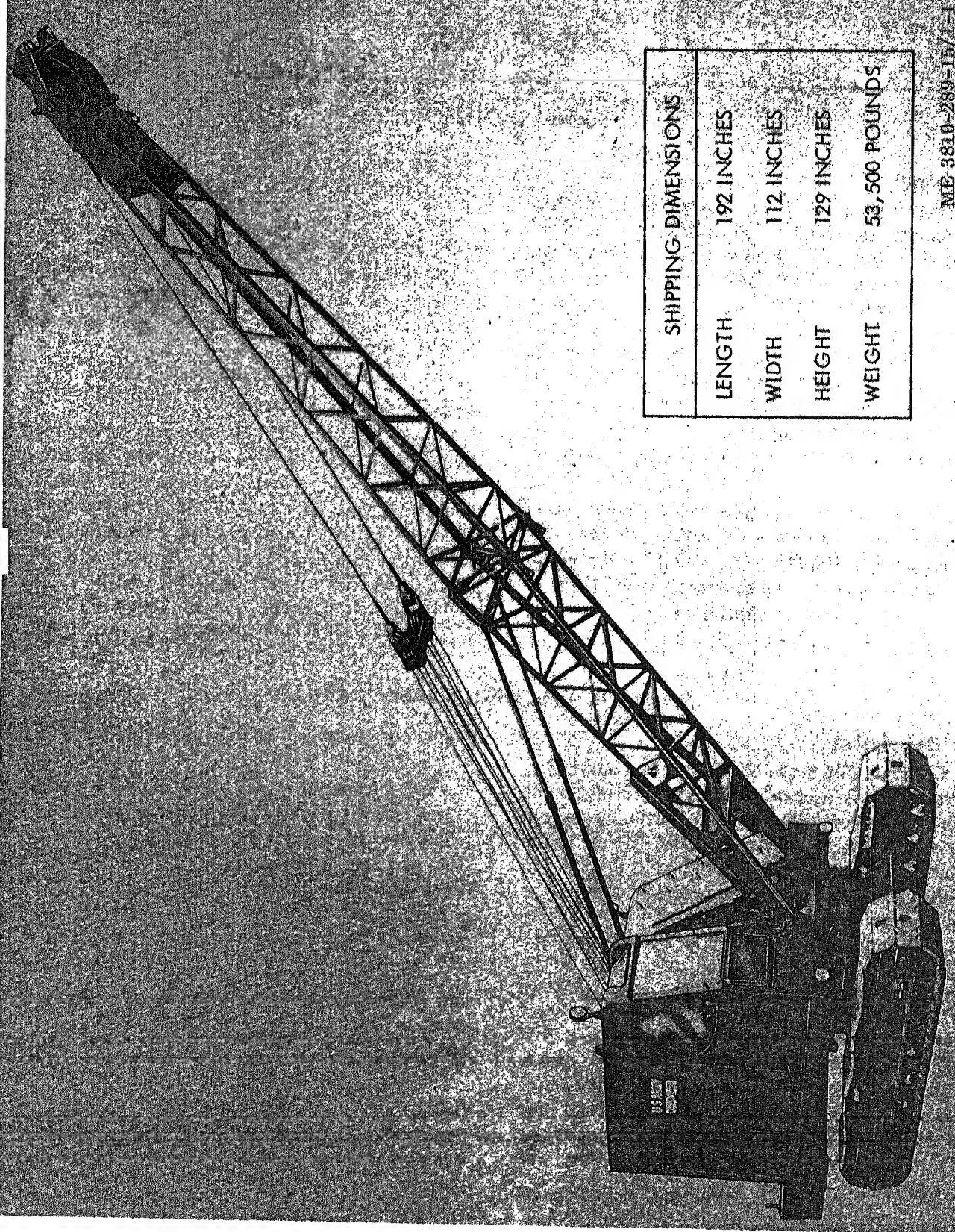
crane, dragline, clamshell, backhoe, piledriver, and shovel components.

(2) The upper works consist of the revolving frame, main machinery, engine, operating controls, and the operator's cab. The necessary controls and instruments provided for operating the crane-shovel are located in the operator's compartment, in front of and to the left of the operator's seat.

(3) The lower works consist of the steering and propelling machinery, truck frame, crawler frames, track rollers and idlers, and the track belts.

c. *Dragline.* The dragline consists of the crane boom, fairlead, dragline bucket, and the hoist and drag cables. The fairlead assembly is mounted inside the lower section of the boom feet to guide the bucket drag cable. The dragline is used for excavating materials below machine level.

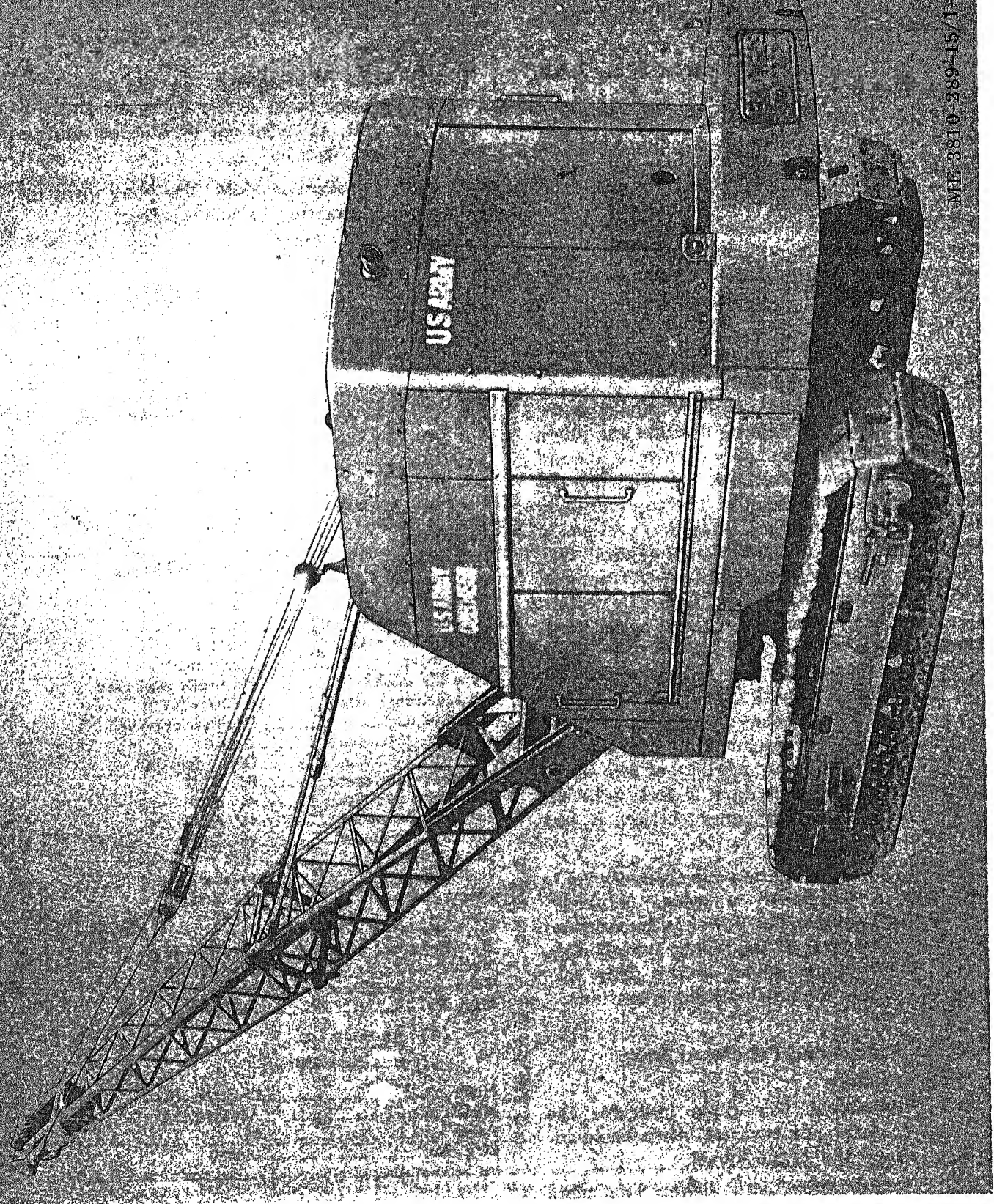
d. *Clamshell.* The clamshell consists of the crane boom, clamshell bucket, and tagline. The



SHIPPING DIMENSIONS			
LENGTH	192 INCHES		
WIDTH	112 INCHES		
HEIGHT	129 INCHES		
WEIGHT	53,500 POUNDS		

MB 3810-289-15/1-1

Figure 1-1. Right front view of model 22BM crane-shovel.



ME 3810-289-15/1-

Figure 1-2. Left rear view of model 22BM crane-shovel.

clamshell may be equipped with teeth for excavating, or without teeth for rehandling materials in a stock pile. The tagline prevents bucket oscillation during operation.

e. Backhoe. The backhoe consists of the backhoe boom, dipper, dipper handle, and an auxiliary A-frame. The dipper handle is hinged at the boom point to allow scoop action by the dipper as it is pulled in toward the boom. The digging action of the backhoe is opposite that of the shovel.

f. Shovel. The shovel consists of a shovel boom, dipper, dipper handle, and a dipper trip cable mechanism. A shipper shaft and saddle block, mounted midway in the boom, holds and guides the dipper handle. The shovel is used for scooping away from the machine.

g. Piledriver. The piledriver uses the crane boom. Hammer leads are attached to the boom point to hold the pile in driving position and guide the hammer. The hammer leads consist of one top section and four lower sections, comprising a 55-foot pile-driving lead assembly. The top section is fifteen feet long. Each of the four lower sections is ten feet long. The lead assembly can be used with all drop hammers weighing up to 3,000 pounds, and with all air, steam, or diesel hammers weighing up to 12,000 pounds. It is adaptable to all power-excavator-crane-shovels listed in MIL-STD-179-8, tables I, II, and III. At the lower end of the lead assembly, a catwalk attached between brackets on the boom foot and lower lead section holds the lead assembly in driving position. The catwalk assembly consists of two interchangeable outer sections, each 7 feet, 8 inches long, and one telescoping inner section, 8 feet long.

h. Power. Power to operate the crane-shovel is supplied by a 6-cylinder, 4 cycle, naturally-aspirated diesel engine. The power is transmitted from the engine, through the power takeoff unit, the chain drive transmission, to the main machinery controlling the crane-shovel operations.

1-5. Identification and Tabulated Data

a. Identification.

(1) *Crane-shovel.* The plate indicates the make, model, serial number and other basic information about the crane-shovel.

(2) *Transportation data plate.* The plate contains transportation information regarding shipment of the crane-shovel.

(3) *Upper section plate.* The plate identifies the proper upper boom section to be used with a particular unit, as called out by a serial number on the plate.

(4) *Lower section plate.* The plate identifies the proper lower boom section to be used with a particular unit, as called out by a serial number on the plate.

(5) *Cold starting plate.* The plate gives instructions on starting in cold weather.

b. Tabulated Data.

(1) *Crane-shovel.*

Manufacturer	Bucyrus-Erie Co.
Model	22BM
Type	Crawler mounted
Serial numbers	129566—129742
	129905—130081
	131944—131963
	132052—132151

(2) *Engine.*

Manufacturer	Cummins
Model	JN-6-1
Number of cylinders	6
Type of engine	Diesel
Cycle	4
Unit	Fan to flywheel
Bore (in.)	4 1/2 in.
Stroke (in.)	5 in.
Displacement (cu. in.)	401
Compression ratio	16.3 : 1
Type drive	Mechanical
Type air intake	Naturally aspirated
Altitude-range (ft.)	0-5000+107°F
Rotation	Counterclockwise
Cooling	Liquid
Fuel	Diesel fuel oil
Exhaust valve opens	62° BBC
Exhaust valve closes	44° ATC
Intake valve opens	44° BTC
Intake valve closes	40° ABC
Gross 3 HP	101
Lubrication	Pressure
Firing order	1-5-3-6-2-4

(3) *Starting motor.*

Manufacturer	Leece-Neville
Model	M001093018
Volts	24
Mfg. No.	186763

(4) *Accessories.*

(a) Alternator.

Make	Leece-Neville
Model	A001300ZAC
Amps	60
Mfg. No.	183380

(b) Air cleaner element.

Make	Donaldson
Model	FWA08-0022
Type	Dry

Type ----- Mechanical variable-speed

(d) *Fuel injector.*

Make ----- Cummins
Model ----- PT

(e) *Fuel pump.*

Make ----- Cummins
Model ----- G

(f) *Fuel filter.*

Make ----- Fram
Model ----- FRM-1826

(g) *Batteries.*

Make ----- MIL-STD-MS 35000-3
Type ----- 6 TH (dry charge)
Volts ----- 12
Qty ----- 4 ea

(5) *Capacities.*

Oil filter ----- 4 quarts
Fuel tank ----- 50 gallons
Fuel filter ----- 3 quarts
Coolant system ----- 7 gallons

(b) *Crane-shovel.*

Transmission gear case ----- 3 quarts
Machinery gear case ----- 8 gallons
Propel gear case ----- 2 quarts

(6) *Adjustment data.* Refer to the appropriate chapter and paragraph for the adjustment of specific components.

(7) *Settings.*

Thermostat full open ----- 195°

(8) *Nut and bolt torque data.* Refer to appropriate paragraph for nut and bolt torque data.

(9) *Maximum allowable lifting loads.* Refer to figure 1-3 for crane boom angles.

Table 1-1. *Operating Ranges*

Boom length in feet	Radius in feet	Boom angle in degrees	Boom point pin height	Crane service
30	12	73	33' 6"	25,000
	15	67	32' 6"	19,000
	20	57	29' 9"	12,9000
	25	44	25' 6"	9,600
	30	28	18' 6"	7,600
40	12	78	43' 9"	24,800
	15	73	42' 9"	18,800
	20	66	41' 0"	12,700
	25	57	38' 3"	9,400
	30	48	34' 6"	7,350
	35	38	29' 3"	6,000
	40	24	21' 0"	5,000
50	15	77	53' 3"	18,600
	20	71	51' 9"	12,400
	25	65	49' 9"	9,200
	30	58	47' 0"	7,150
	35	51	43' 6"	5,750
	40	43	38' 9"	4,750
	50	21	28' 0"	3,400
60	20	74	62' 3"	12,200
	25	69	60' 6"	8,950
	30	64	58' 6"	6,900
	35	58	55' 9"	5,550
	40	53	52' 3"	4,500
	50	39	42' 6"	3,150
	60	20	24' 9"	2,300

Note. The preceding ratings apply only to machines that are level and standing on hard level uniform supporting surfaces. Loads must be freely suspended. The radii specified are loaded radii. Ratings include blocks, hooks, slings, or other equipment used in handling loads. Proper care must be exercised by the operator at all times to avoid shock or side loadings on the boom. Loads do not exceed 75% of tipping loads with the machine in the least stable position. Loads shown in table 1-1 are for general crane service with the machine on firm, level ground. Maximum boom angle is 78%.

ts of line ----- 2 ----- 3 ----- 4 -----
 duct weight of hook blocks, hooks and slings
 m listed loads:
 2-ton double sheave swivel hook block
 eighs ----- 195 lbs

(11) *Jibs*. Use jibs for lifting crane service
 y. Allowable loads on main boom sheave, when
 is attached, must be reduced as follows:

ft jib ----- 800 lbs
 e allowable load over the jib sheave, at any
 ius from centerline of rotation of the ma-
 ne, is the same load that may be lifted over
 boom sheave (without jib) with boom lowered
 that radius, but not to exceed 7,500 lbs. Maxi-
 m length of boom to which a jib may be at-
 hed is 60 ft.

(a) Hook block.

Capacity ----- 12.5 tons
 Weight ----- 195 lbs

(b) Wire rope specification.

Pendant (2) ----- 1 in. dia. x 15 ft
 Tackle rope ----- ½ in. dia. x 211 ft
 Hoist rope ----- See table 4-2

(c) Wiring diagram. Refer to figure 1-4.

(d) *Shipping dimension and weights*. Re-
 fer to figure 1-1. Bridge weight classification is
 27.

1-6. Difference in Models

This manual covers only the model 22BM
 crane-shovel. No known unit differences exist for
 the model covered by this manual.

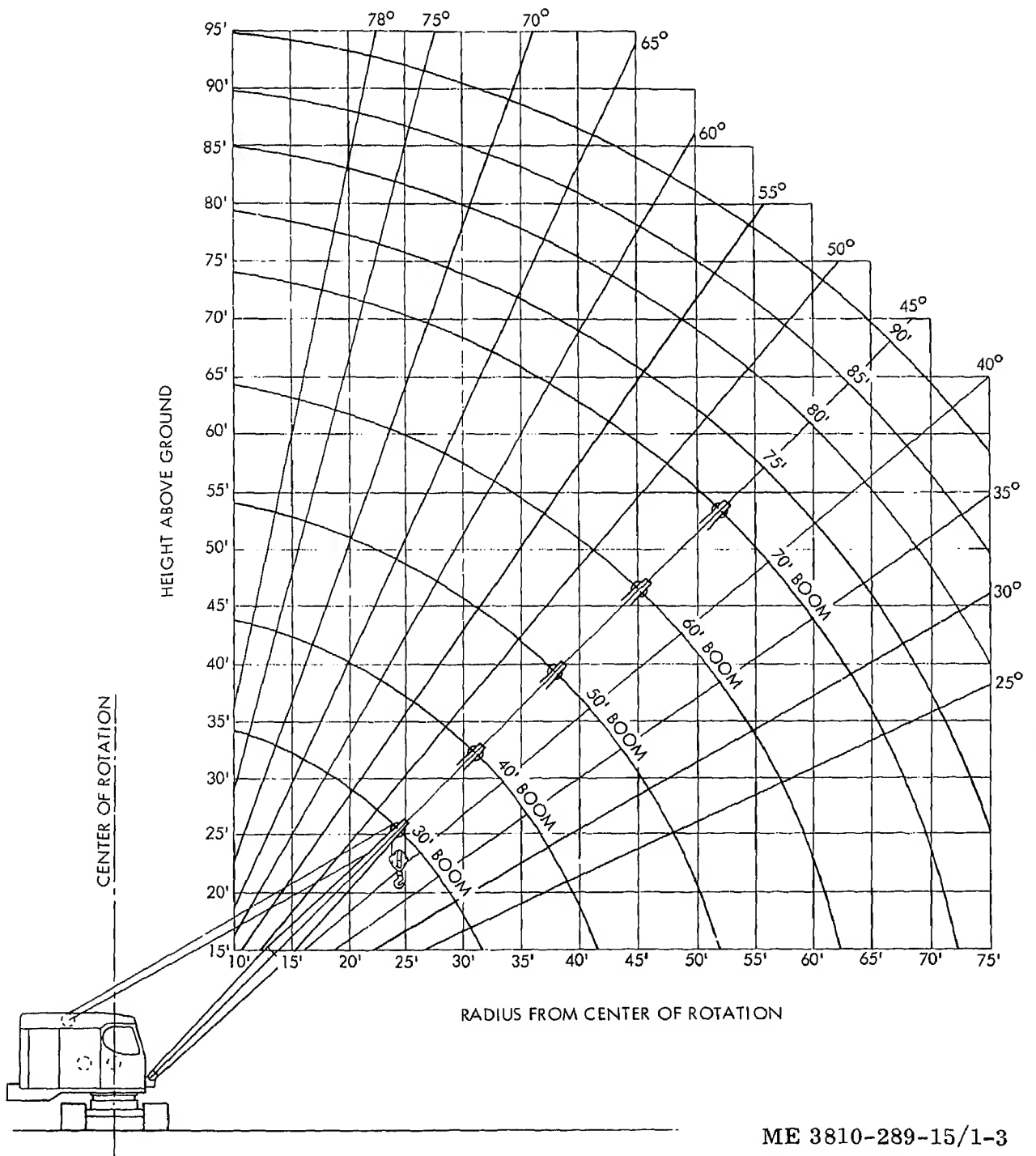
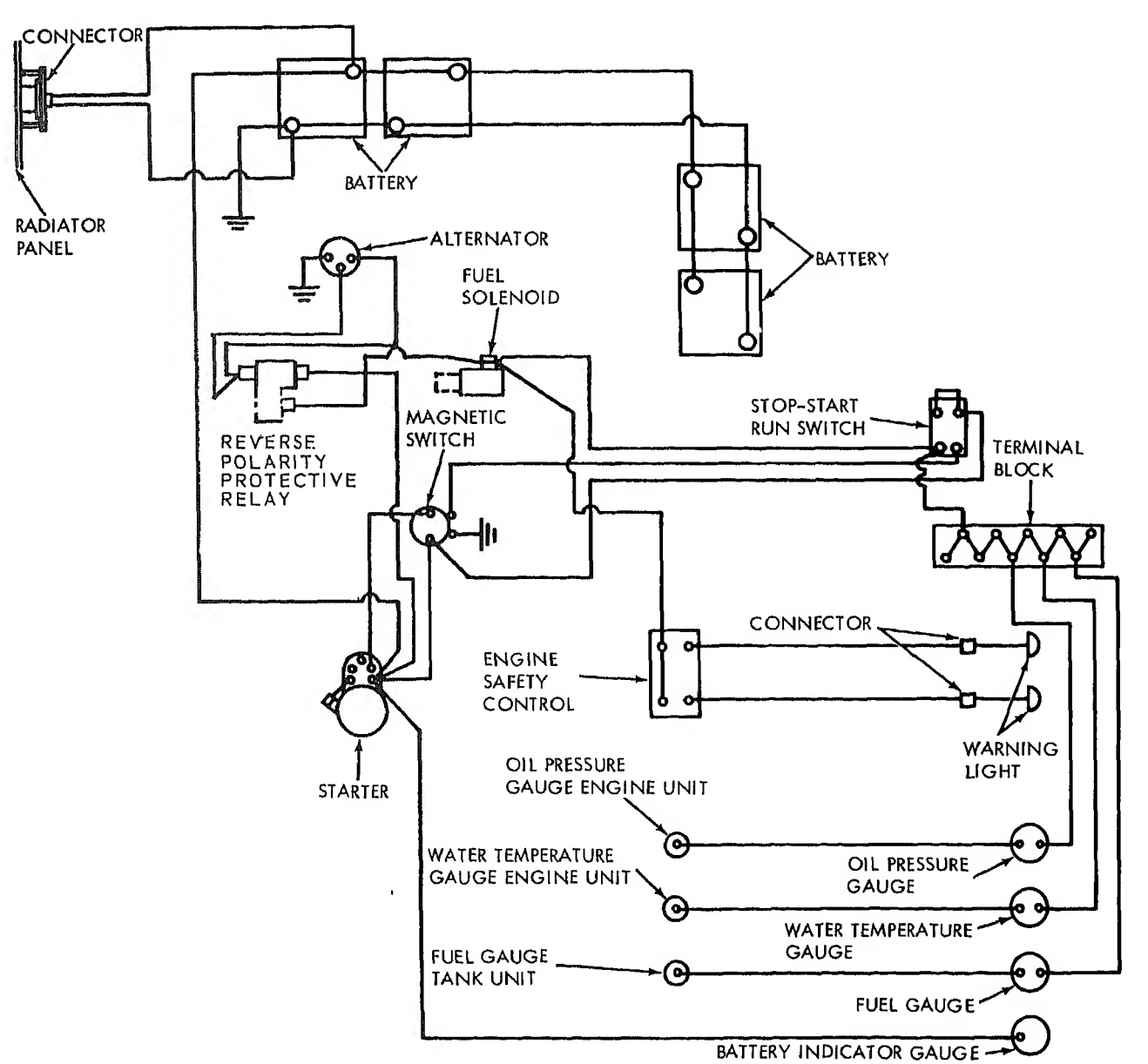
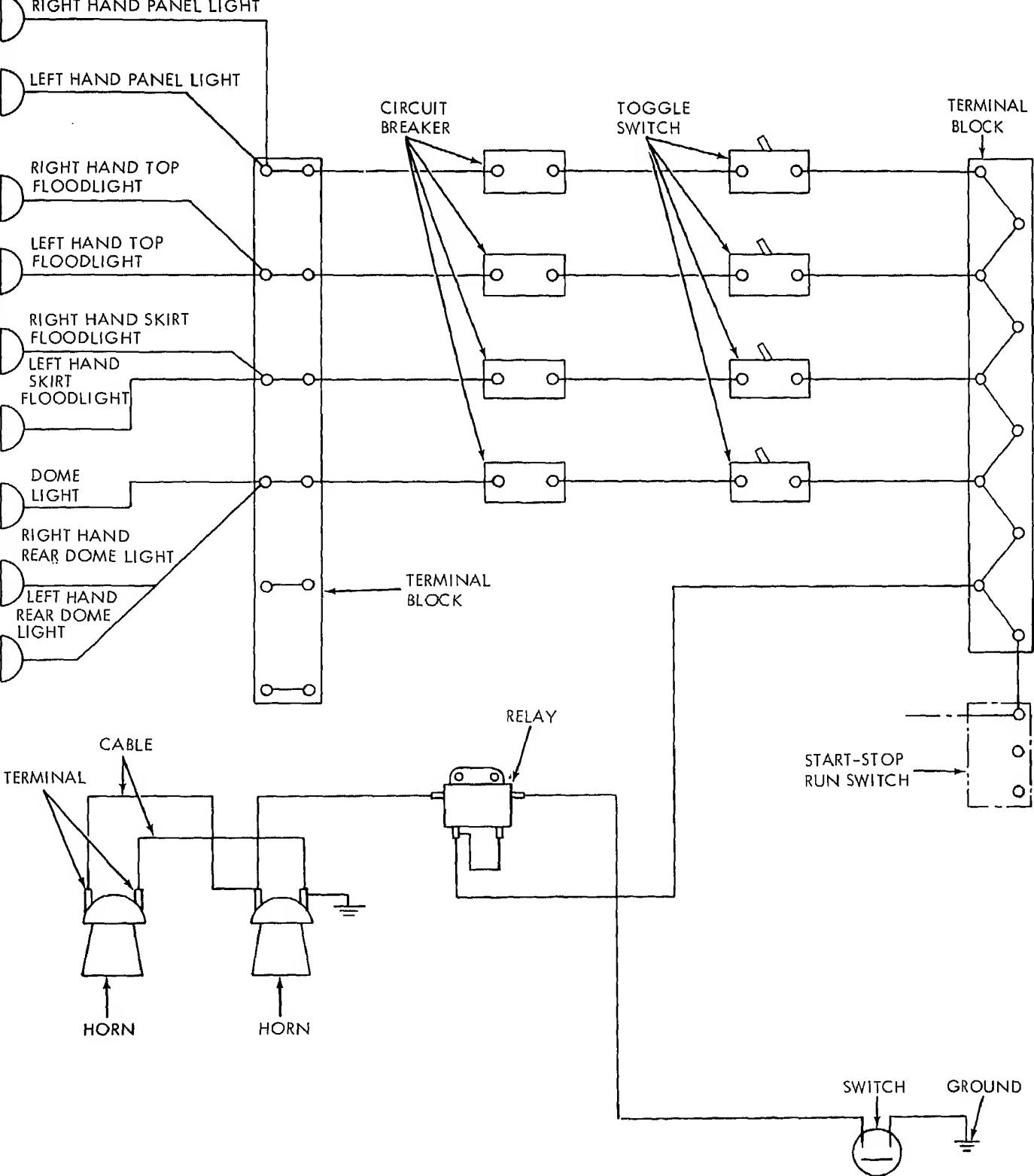


Figure 1-3. Crane boom angle chart.



ME 3810-289-12/1-4 ①

Figure 1-4. Electrical system, schematic diagram (sheet 1 of 2).



ME 3810-289-15/1-4 (2)

Figure 1-4. Electrical system, schematic diagram (Sheet 2 of 2).

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. Inspecting and Servicing the Equipment

a. General. When a crane-shovel unit is received by the organization, it must be thoroughly inspected and serviced to insure that it is in good operating condition.

b. Inspecting the Equipment.

(1) Make a complete visual inspection to make sure the required tools, repair parts, and publications are with the equipment.

(2) Inspect the unit for missing items or damage that may have occurred during shipment.

(3) Inspect all components for loose mounting hardware or connections.

(4) Inspect wiring, fuel and oil lines, radiator and hoses, gages and instruments and lights, for missing items, and broken, loose, or damaged parts.

(5) Inspect engine compartment for loose or missing parts, or damage to air cleaner, manifold, muffler, fuel pump, or fuel lines.

(6) Inspect fuel tank filler pipe for dents, cracks, or other damage. Insure removal of all preservative or barrier material.

(7) Inspect battery installation for tightness of cables, level of electrolyte, and for proper connection.

Note. The crane is wired with a negative ground.

(8) Inspect drain plugs, filler caps, and drain cocks, to be sure they are secured and not leaking or damaged.

(9) Inspect cab for broken windows or door glass.

(10) Inspect floodlights for serviceability, and test operation of switches on control panel.

(11) Inspect all controls for freedom of movement through operating range, and make sure all handles or knobs are in place.

(12) Report all discrepancies to proper authority.

c. Servicing the Equipment. After the equipment has been unpacked and separately packed components have been installed (para 2-2), the equipment must be serviced as follows:

(1) Perform the necessary preventive maintenance checks and services (para 3-6).

(2) Lubricate the crane-shovel in accordance with current lubrication order and paragraph 3-4.

(3) Fill engine crankcase with oil as specified in lubrication order.

Caution: Connect negative connection last when installing batteries.

(4) Connect the battery cables (fig. 2-1).

(5) Remove filler caps and check electrolyte level. It should be approximately $\frac{3}{8}$ inch above the cell plates. Add distilled water if necessary.

Note. Batteries may be shipped separately or installed dry charged, with electrolyte shipped separately.

(6) If the unit is received with dry-charge batteries, service as follows:

Warning: Exercise care when filling batteries with electrolyte to prevent splashing or spilling the acid on clothing and body. Do not smoke or use open flame in the vicinity. Batteries generate explosive gas during charging.

(a) Remove box cover and filler caps.

(b) Pour electrolyte into each battery cell to a depth of $\frac{3}{8}$ inch above the separators.

(c) Install the filler caps and battery box cover.

(7) Service cooling system (TB 750-651) with water or proper mixture of antifreeze solution. For cold weather operation requirements, refer to paragraph 2-23.

(8) Fill the fuel tank.

2-2. Unpacking Separately Packed Components

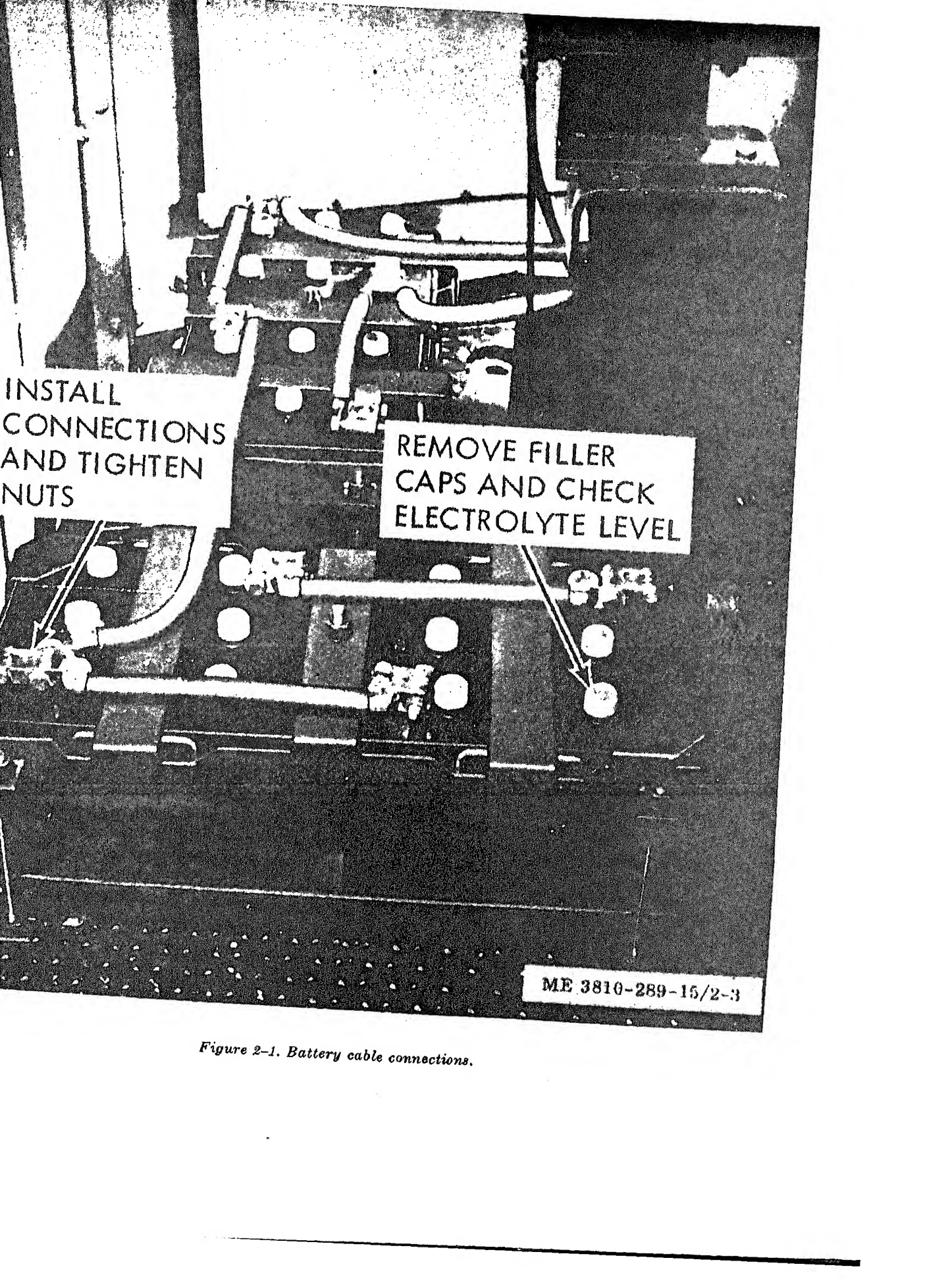
a. The following items are packed in watertight boxes. Use care in removing covers from boxes so that damage is not incurred in unpacking.

(1) Hook block.

(2) Pendant bridle.

(3) Boom angle indicator.

(4) In addition, the counterweight will be shipped disassembled from the crane-shovel.

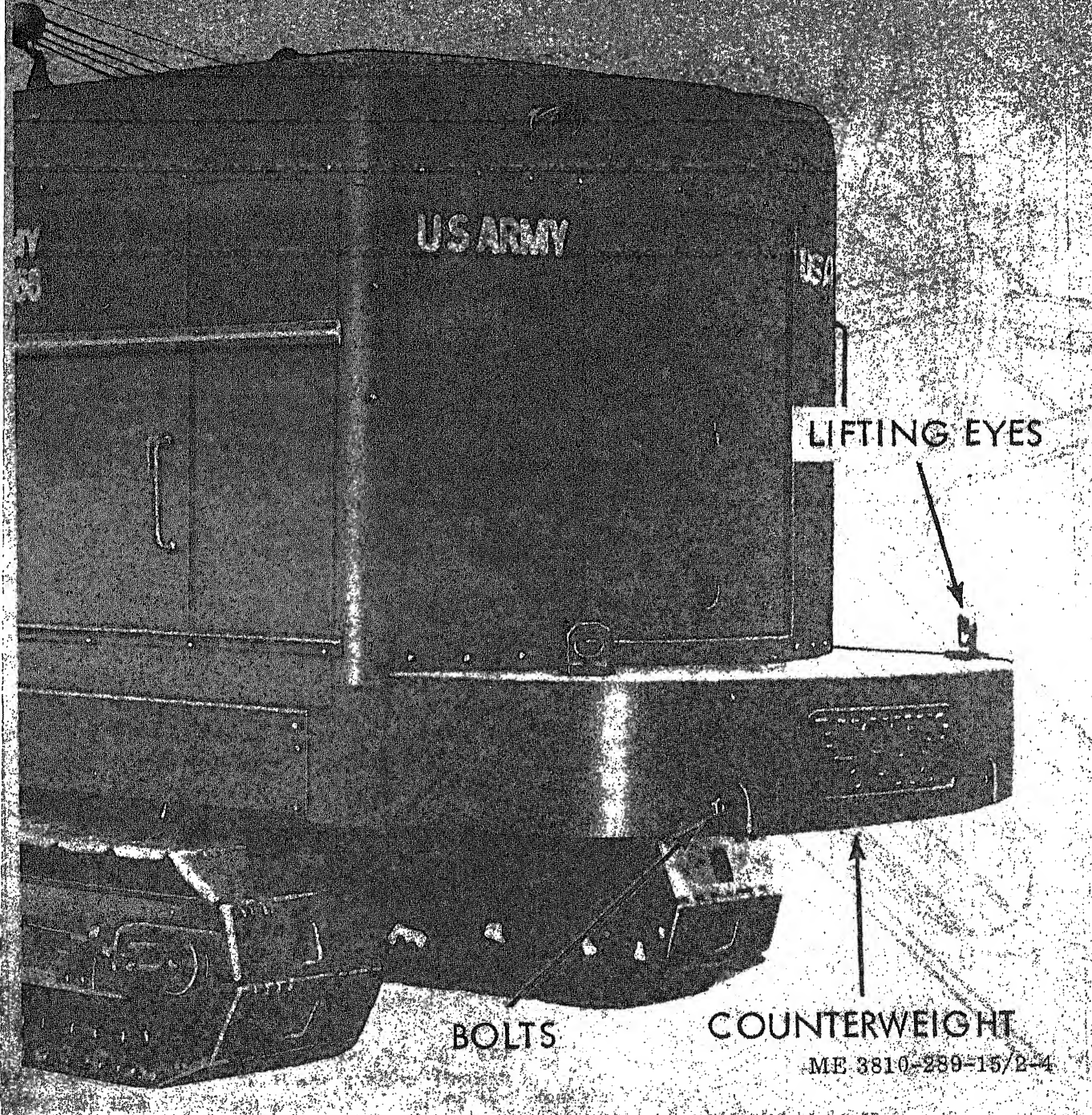


INSTALL
CONNECTIONS
AND TIGHTEN
NUTS

REMOVE FILLER
CAPS AND CHECK
ELECTROLYTE LEVEL

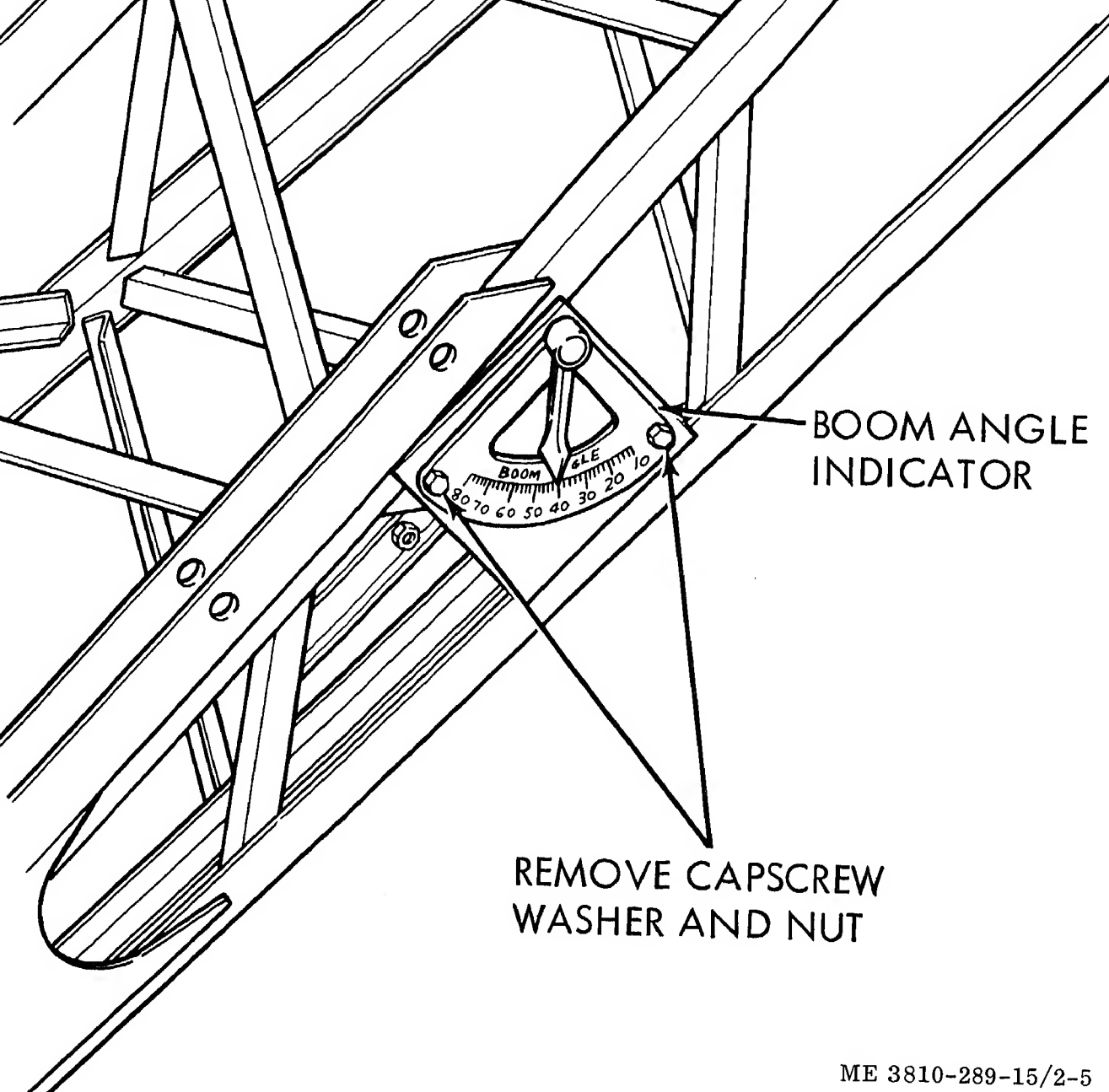
ME 3810-289-15/2-3

Figure 2-1. Battery cable connections.



Counterweight.

Figure 2-2. Installation of counterweight and boom angle indicator (sheet 1 of 2).



ME 3810-289-15/2-5

Boom angle indicator.

Figure 2-2. Installation of counterweight and boom angle indicator (sheet 2 of 2).

2-3. Installation or Setting-Up Instructions

a. Installation of Separately Packed Components.

(1) *Counterweight.* Install the counterweight into position at the rear of the cab as shown in figure 2-2.

Caution: The counterweight weighs 7000 pounds. Use suitable hoisting equipment and caution when installing.

(2) *Boom.* Refer to paragraph 4-56 for boom installation.

(3) *Boom angle indicator.* Refer to figure 2-2 and assemble the boom angle indicator to the lower boom section.

(4) *Hook block.* Refer to paragraph 4-55 for hook block installation.

b. Setting-Up Instructions for Crane Operation.

(1) *Description of equipment required.* Refer to paragraph 1-4.

(2) *Installation of separately packed components.* Refer to paragraph a., above.

(3) *Operating levers.* Refer to figure 2-3 (A) and change operating lever linkage, if not in correct configuration, as follows:

(a) Set levers to neutral.

(b) Remove pin securing reach rod (5) to lever (3); remove reach rod (5), place on lever (4) and install pin.

(c) Remove capscrews (10) securing lever extension (8) to short lever extension (6). Insert capscrew (10) through short lever (9) and secure lever extension (8) to short lever (9).

(d) Middle lever (1) now controls rear drum reach rod (5) and hoist lever (2) controls front drum reach rod (7).

(4) *Operating pedals.* Refer to figure 2-4 (B) and change operating pedal linkage, if not in correct configuration, as follows:

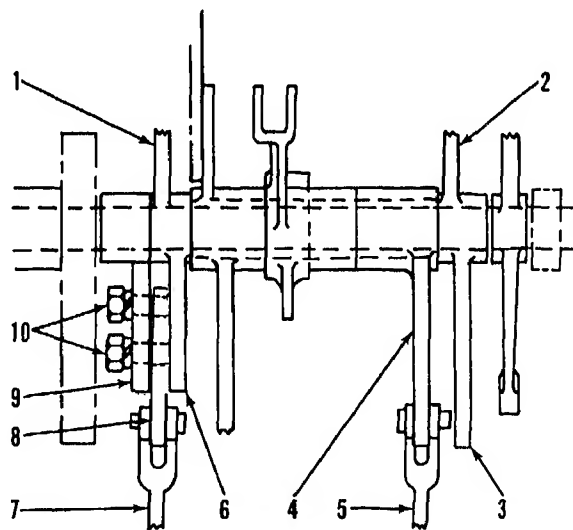
(a) Disconnect long reach rod (2) and short reach rod (1) at brake pedals. Remove levers (6) and (7) from shafts (3) and (4) by loosening clamping bolts. (8).

(b) Remove spacer from shaft (3) and install on shaft (4).

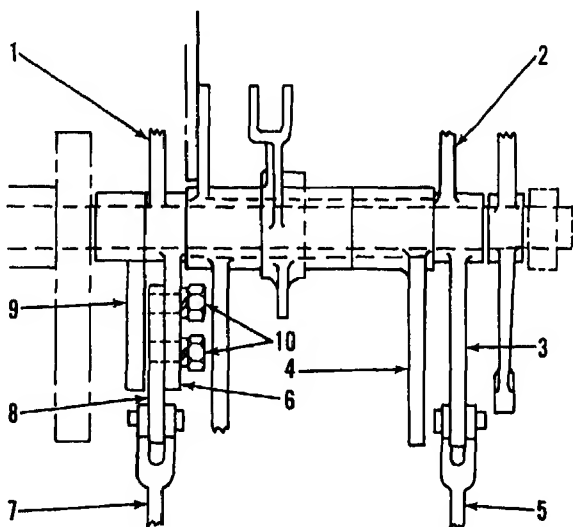
(c) Install lever (6) on shaft (3) and lever (7) on shaft (4). Tighten clamping bolts. (8).

(d) Connect long reach rod (2) and short reach rod (1) to brake pedals.

(e) Right pedal controls front drum brake and left pedal controls rear drum brake.



A. CRANE, DRAGLINE, CLAMSHELL AND BACKHOE OPERATING LEVER CONFIGURATION.



B. SHOVEL OPERATING LEVER CONFIGURATION.

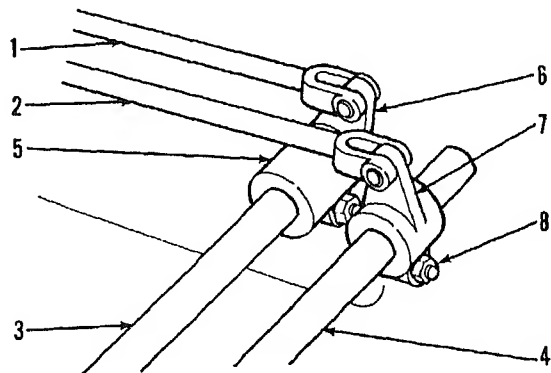
ME 3810-289-12/2-3

- 1 Middle lever
- 2 Hoist lever
- 3 Short lever
- 4 Lever
- 5 Rear drum reach rod
- 6 Short lever extension
- 7 Front drum reach rod
- 8 Lever extension
- 9 Short lever
- 10 Capscrews

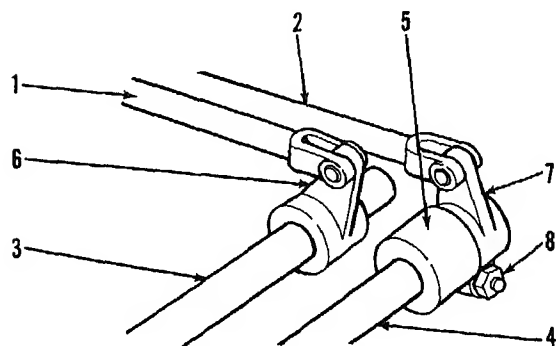
Figure 2-3. Operating levers.

in correct configuration, as follows:

- (a) Disconnect reach rods (2) and (3) by removing cotter pins (7) and pins (6).
- (b) Turn bellcrank (1) to correct position.
- (c) Connect reach rod (3) by installing pin (6) and cotter pin (7).
- (d) Loosen locknut (5) $\frac{1}{4}$ -turn and remove reach rod (2).
- (e) Swing clevis (4) to correct position.
- (f) Install reach rod (2) and connect by installing pin (6) and cotter pin (7).



A. SHOVEL, BACKHOE, CLAMSHELL AND DRAGLINE OPERATING PEDAL CONFIGURATION.

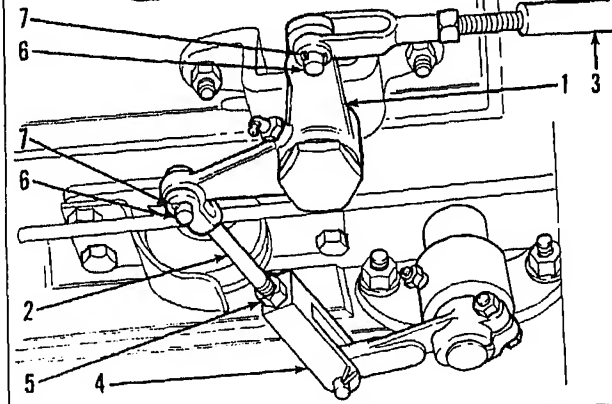


B. CRANE OPERATING PEDAL CONFIGURATION.

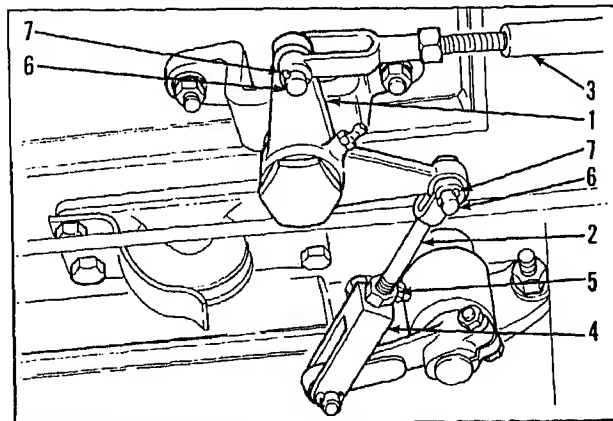
ME 3810-289-12/2-4

- 1 Short reach rod
- 2 Long reach rod
- 3 Rear drum brake shaft
- 4 Front drum brake shaft
- 5 Spacer
- 6 Brake shaft lever
- 7 Brake shaft lever
- 8 Clamping bolts

Figure 2-4. Operating pedals.



A. SHOVEL CROWD CLUTCH LINKAGE CONFIGURATION.



B. CRANE, DRAGLINE, CLAMSHELL AND BACKHOE CROWD CLUTCH LINKAGE CONFIGURATION.

ME 3810-289-12/2-5

- 1 Bell crank
- 2 Reach rod
- 3 Reach rod
- 4 Clevis
- 5 Locknut
- 6 Pin
- 7 Cotter pin

Figure 2-5. Crowd clutch linkage.

- (g) Tighten locknut (5).

(6) *Forward drum brakeband.* Refer to figure 2-6 (A) and change band linkage, if not in correct configuration, as follows:

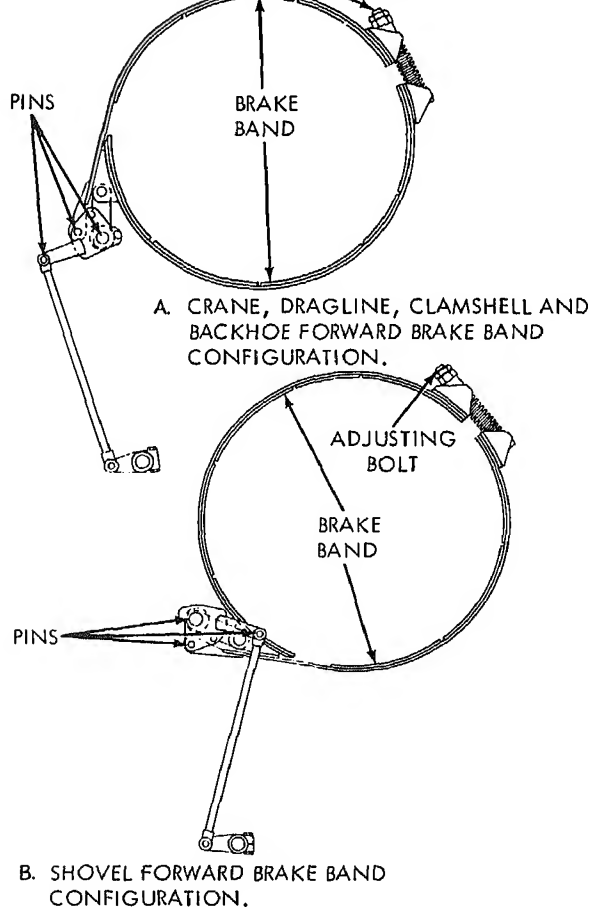
- (a) Remove pins and adjusting bolt.
- (b) Turn bellcrank over and interchange live and dead end halves of the band.

- (c) Install pins and adjusting bolt.

(7) *Cable reeving.* Refer to paragraphs 4-54 and 4-55.

c. Jib Boom Installation.

(1) *General.* The basic components for jib boom installation are a 30-foot boom, boom ex-



ME 3810-289-12/2-6

Figure 2-6. Forward brakeband.

tension, jib strut, jib boom, and jib boom suspension cables. Maximum length of boom to which a jib may be attached is 60 feet.

(2) Installation.

(a) Install crane boom (para 4-56) and hook block (para 4-55).

(b) Secure jib strut to jib boom with pin and cotter pin as shown in figure 2-7.

(c) Position jib boom in the boom point supports and secure with the two pins, cotter pins, rod ends, lockwashers, and capscrews.

(3) Cable reeving.

(a) Secure lower jib support in the dead-end socket in boom cable support; reeve it through the jib strut pulley and secure to dead-end socket on other boom cable support. Position it in the proper hole to give desired jib boom angle.

(b) Reeve upper jib boom point support cable through the strut pulley. Secure the two

(c) Using proper length and size cable, reeve the jib boom cable by securing one end of right-hand drum with the wedge. Reeve the cable between the boom pendant cables and the lower jib support cables, over the jib strut sheave, between the upper jib support cables and then over the jib boom point sheave.

(d) Secure weight hook to cable with cable clamps.

2-4. Equipment Conversions

The crane-shovel is normally equipped as a lifting crane, but front end attachments are available for conversion to dragline, clamshell, backhoe and shovel (figs. 2-8 and 2-9), and piledriver front end operating units. Refer to paragraph 1-4 for description of front end equipment. The following paragraphs provide detailed instructions for converting the machine from a crane to any of the attachments available for use. If the machine is already equipped with other than a crane boom, refer to the applicable paragraph for removal instructions, and the applicable paragraph of the attachment being installed for the installation instructions.

2-5. Dragline Front End Conversion

a. Installation.

(1) *Operating levers.* Refer to paragraph 2-3b (3) for correct operating lever linkage configuration.

(2) *Operating pedals.* Refer to figure 2-4A and change operating pedal linkage, if not in correct configuration, as follows:

(a) Disconnect long reach rod (2) and short reach rod (1) at brake pedal levers.

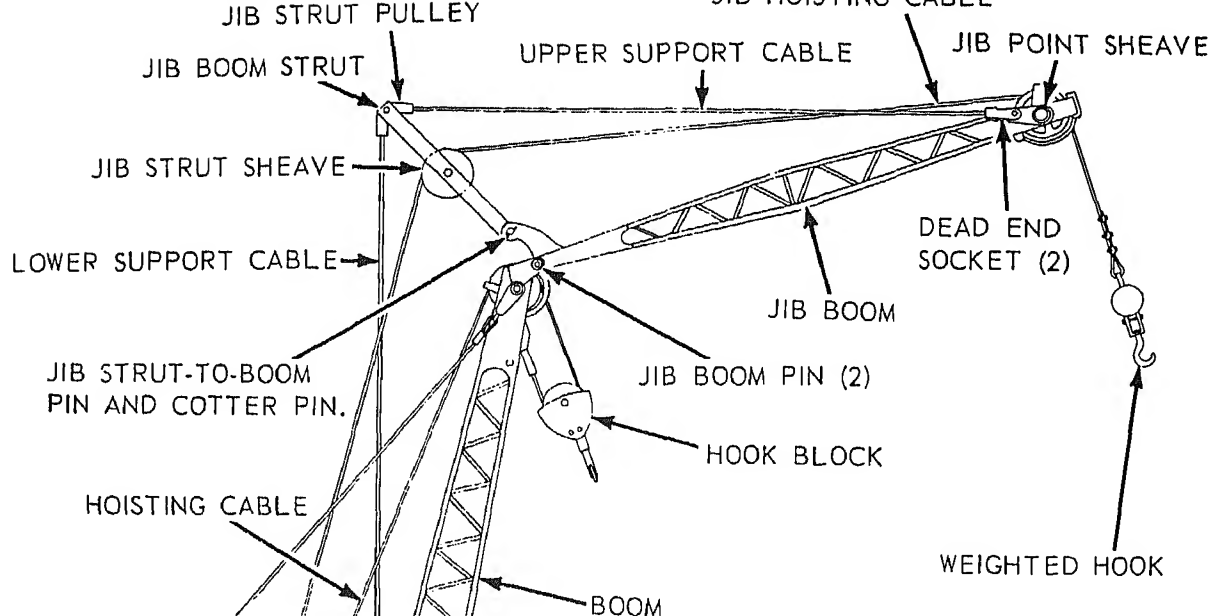
(b) Remove levers (6) and (7) from brake shafts (3) and (4) by loosening clamping bolts (8).

(c) Remove spacer (5) from front drum brake shaft (4) and install on rear drum brake shaft (3).

(d) Install lever (6) on rear drum brake shaft (3). Install lever (7) on front drum brake shaft (4).

(e) Tighten bolts (10).

(f) Left pedal controls front drum brake and right pedal controls rear drum brake.



ME 3810-289-12/2-7

Figure 2-7. Jib boom cable reeving diagram.

(3) *Crowd clutch linkage.* Refer to paragraph 2-3b (5) for correct crowd clutch linkage configuration.

(4) *Forward drum brakeband.* Refer to paragraph 2-3b (6) for correct brakeband linkage configuration.

(5) *Boom installation.* Refer to paragraph 4-56 and install boom.

(6) *Dragline fairlead installation.* Refer to figure 2-10.

(7) *Dragline bucket installation.* Refer to figure 2-11.

(8) *Drag cable reeving.* Refer to figure 2-11.

(a) Refer to table 4-3 for correct cable length.

(b) Lead cable between fairlead sheaves.

(c) Attach end to right side of front drum.

(d) Attach other end to drag chain socket.

(9) *Hoist cable reeving (fig. 2-11).*

(a) Refer to table 4-3 for cable length.

(b) Lead cable over left boom point sheave.

(c) Attach end to right side of rear drum.

(d) Attach other end to dump sheave frame.

(10) *Suspension cable reeving.* Refer to paragraph 4-55.

(11) *Drag bucket adjustment.*

Note. Drag chains are carried in low position for regular digging and in high position for deeper digging. Install drag chain clevis as required (fig. 2-12).

(a) Remove clevis pin locking pin.

(b) Remove clevis pin.

(c) Separate clevis from wearing ring.

(d) Turn clevis over and replace in wearing ring.

Note. Clevis must be reversed to prevent twisting in wearing ring.

(e) Attach clevis to drag bucket.

b. *Removal.* Removal procedure is reverse of installation, a above.

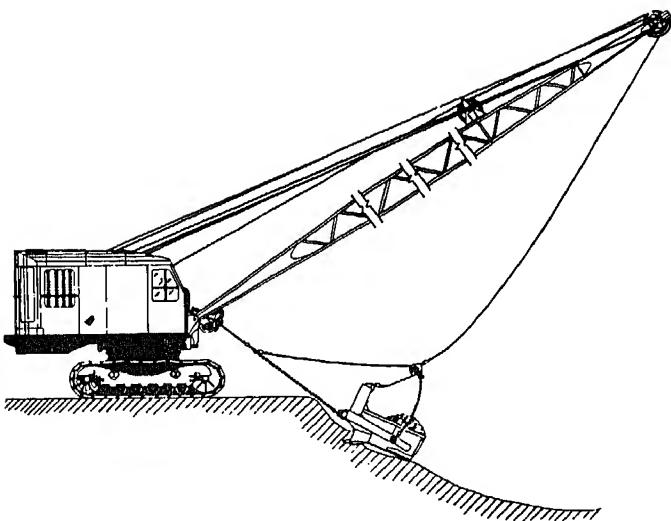
2-6. Clamshell Front End Conversion

a. *Installation.*

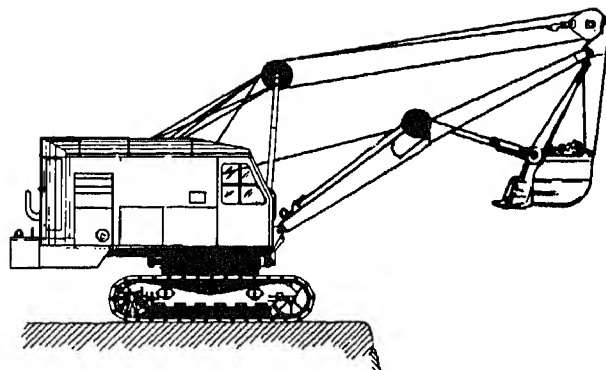
(1) *Operating levers.* Refer to paragraph 2-3b (3).

(2) *Operating pedals.* Refer to paragraph 2-5a (2)

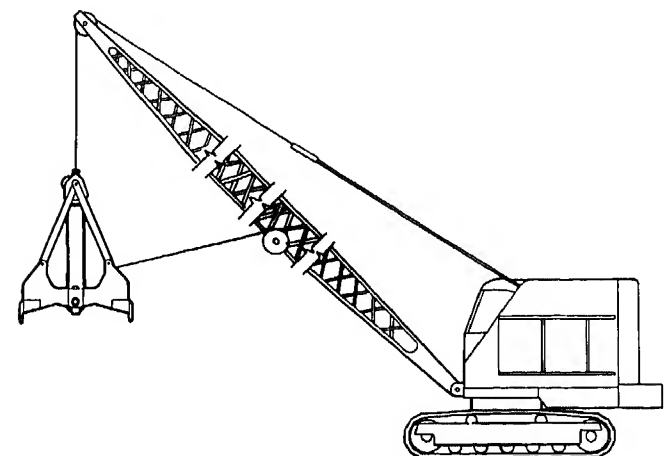
(3) *Crowd clutch linkage.* Refer to paragraph 2-3b (5).



A. DRAGLINE



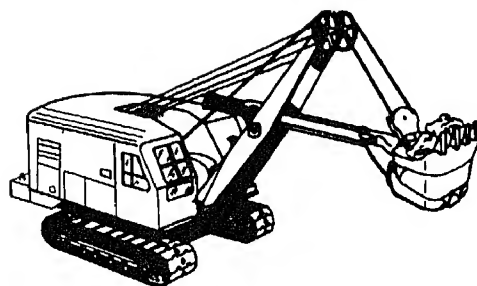
A. BACKHOE



B. CLAMSHELL

ME 3810-289-12/2-8

Figure 2-8. Dragline and clamshell front end attachment.



B. SHOVEL

ME 3810-289-12/2-9

Figure 2-9. Backhoe and shovel end attachment.

(8) *Clamshell bucket installation.* Refer to figure 2-13.

(9) *Cable reeving (fig. 2-14).*

(a) *Suspension cable.* Refer to paragraph 4-54.

(b) *Holding cable.*

1. Refer to table 4-3 for correct cable length.

2. Lead cable over left boom point sheave.

3. Attach end to rear drum.

4. Attach other end to socket on bucket.

(c) *Closing cable.*

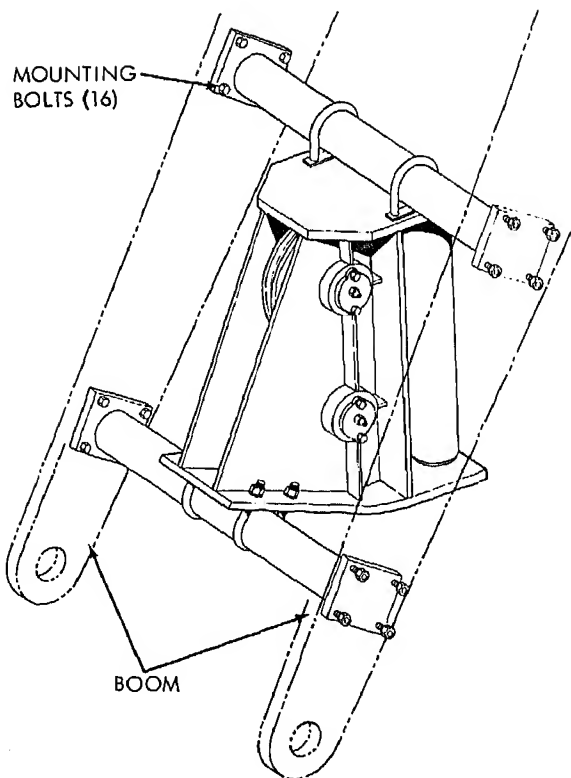
1. Refer to tables 4-2 and 4-3 for correct cable length.

(4) *Forward drum brakeband.* Refer to paragraph 2-3b (6)

(5) *Boom installation.* Refer to paragraph 4-56.

(6) *Boom extension.* Refer to paragraph 4-56.

(7) *Tagline unit installation.* Refer to figure 2-13.



ME 3810-289-12/2-10

Figure 2-10. Dragline fairlead, removal and installation.

2. Lead cable over right boom point sheave.

3. Reeve cable through clamshell sheave and anchor.

4. Attach other end to front drum.

(d) *Tagline cable.*

1. Lead cable from tagline unit over sheave to bucket.

2. Anchor end to clamshell bucket.

(10) *Tagline unit adjustment (fig. 2-13).* Turn cable wheel counterclockwise to wind tagline spring.

b. *Removal.* Removal procedure is reverse of installation.

2-7. Backhoe Front End Conversion

a. *Installation.*

(1) *Operating levers.* Refer to paragraph 2-3b (3).

(3) *Crowd clutch linkage.* Refer to paragraph 2-3b (5).

(4) *Forward drum brakeband.* Refer to paragraph 2-3b (6).

(5) *Backhoe boom installation.*

(a) Build cribbing to support backhoe boom at correct height (fig. 2-15).

(b) Propel machine forward until boom feet enter lugs on revolving frame. Use jack to raise or lower boom until aligned.

(c) Install boom foot pins and locking bolts.

(6) *Auxiliary A-frame installation (fig 2-16).*

(a) Place auxiliary A-frame in lugs on revolving frame.

(b) Install pins and locking bolts.

(7) *Auxiliary A-frame suspension cable reeving (fig. 2-16).*

(a) Refer to table 4-1 for correct cable length.

(b) Lead cable over right auxiliary A-frame sheave.

(c) Lead cable around A-frame yoke sheave and under left auxiliary A-frame sheave.

(d) Lead cable over left A-frame sheave and attach to boom hoist drum.

(e) Attach other end to anchor on A-frame.

(8) *Roller and spacer assembly arrangement.*

(a) Model 22BM crane-shovel roller and spacer assembly is shown in figure 2-17.

(b) Spacers and shaft dimensions are shown in figure 2-18.

(9) *Backhoe cable reeving (fig. 2-16).*

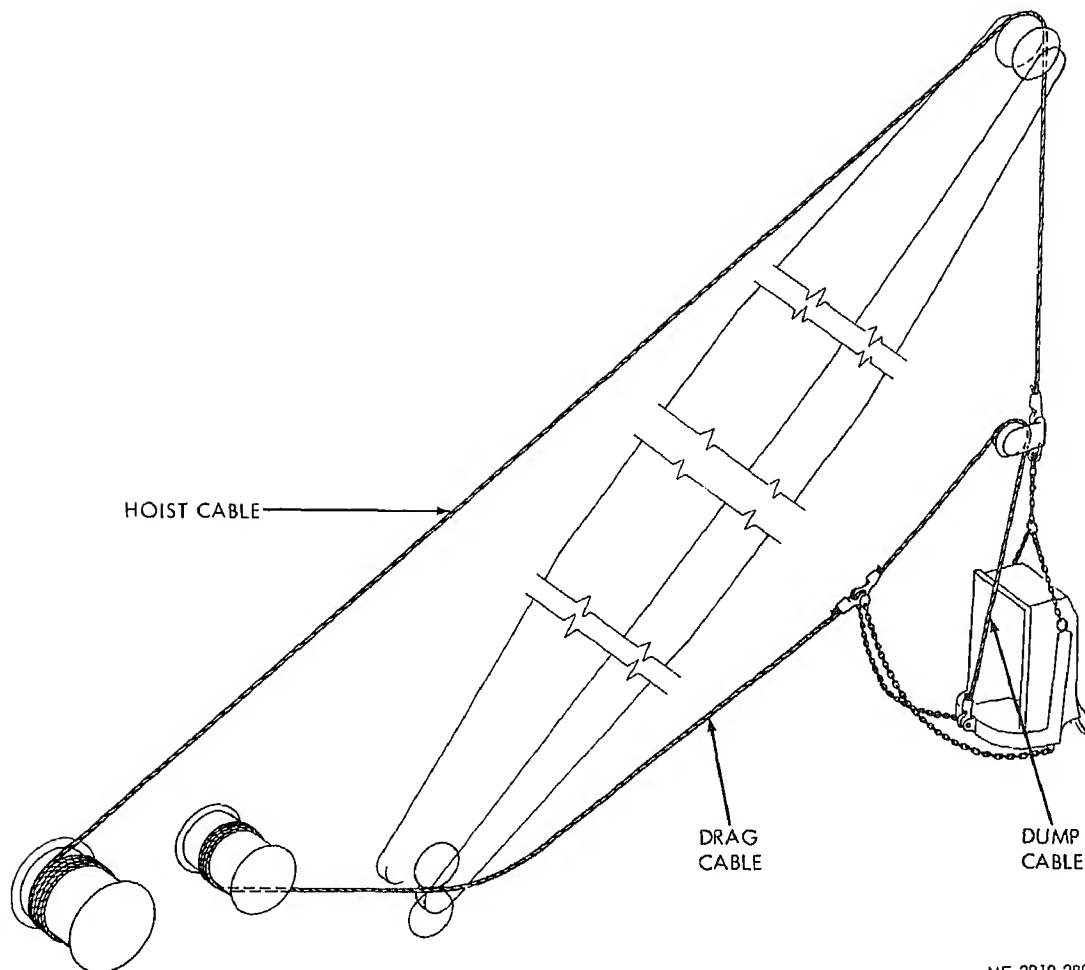
(a) *Hoist cable.*

1. Refer to table 4-3 for correct cable length.

2. Lead cable over right center A-frame sheave.

3. Lead cable under and around dipper handle sheave over the left center A-frame sheave and attach to hoist drum.

4. Attach other end to anchor on dipper handle.



ME 3810-289-12/2-11

Figure 2-11. Dragline cable reeving.

(b) *Drag cable.*

1. Refer to table 4-3 for correct cable length.
2. Lead cable over left guide sheave, around padlock sheave, and over right guide sheave.
3. Attach end to drag drum.
4. Attach other end to anchor on left side of boom.

b. Removal. Removal procedure is reverse of installation.

(a) Set levers to neutral.

(b) Remove pin securing reach rod (5) to lever (4); remove reach rod (5), place on lever (3) and install pin.

(c) Remove capscrews (10) securing lever extension (8) to short lever (9). Insert capscrews (10) through short lever extension (6) and secure short lever extension (6) to lever extension (8).

(d) Middle lever (1) now controls front drum reach rod (7) and hoist lever (2) controls rear drum reach rod (5).

(2) *Operating pedals.* Refer to figure 2-4b.

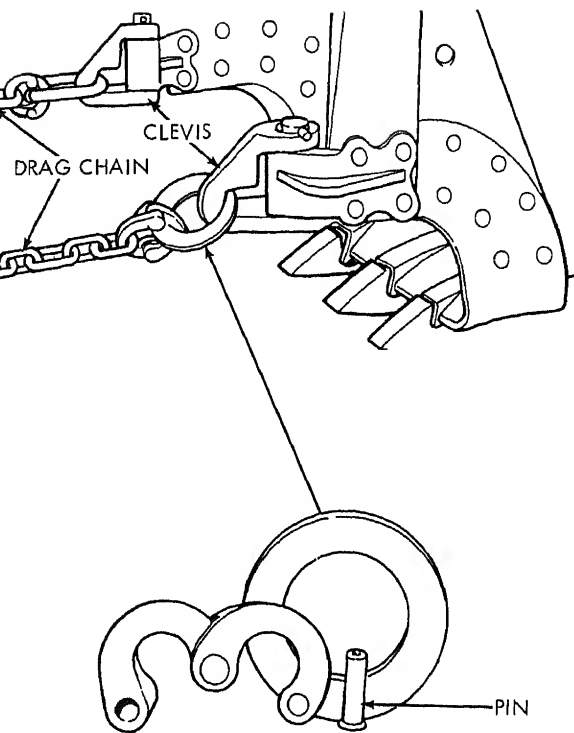
(3) *Installation of crowd chain sprocket on front drum.* Refer to figure 2-19.

(4) *Rear crowd chain installation (fig. 2-20).*

2-8. Shovel Front End Conversion

a. Installation.

(1) *Operating levers.* Refer to figure 2-3 (B) and change operating levers linkage, if not in correct configuration, as follows:



ME 3810-289-12/2-12

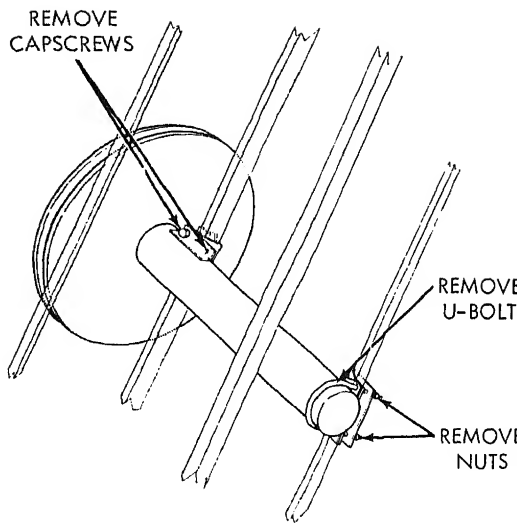
Figure 2-12. Drag chain clevis, removal and installation.

- (a) Install connecting link.
- (b) Install connecting link pin.

(5) *Crowd chain adjusting bracket installation.* Refer to figure 2-21.

(6) *Crowd clutch linkage.* Refer to figure 2-5(A) and change crowd clutch linkage, if not in correct configuration, as follows:

- (a) Disconnect reach rods (2 and 3) by removing pins (6) and cotter pins (7).
- (b) Turn bellcrank (1) to correct position.



ME 3810-289-12/2-13

Figure 2-13. Tagline unit, removal and installation.

(g) Connect reach rod (2) by installing pin (6) and cotter pin (7).

(h) Tighten locknut (5).

(7) *Forward drum brakeband.* Refer to figure 2-6(B) and change band linkage, if not in correct configuration, as follows:

- (a) Remove pins and adjusting bolt.
 - (b) Turn bellcrank over and interchange live and dead-end halves of the band.
 - (c) Install pins and adjusting bolt.
- (8) *Shovel boom, dipper, and handle installation.*

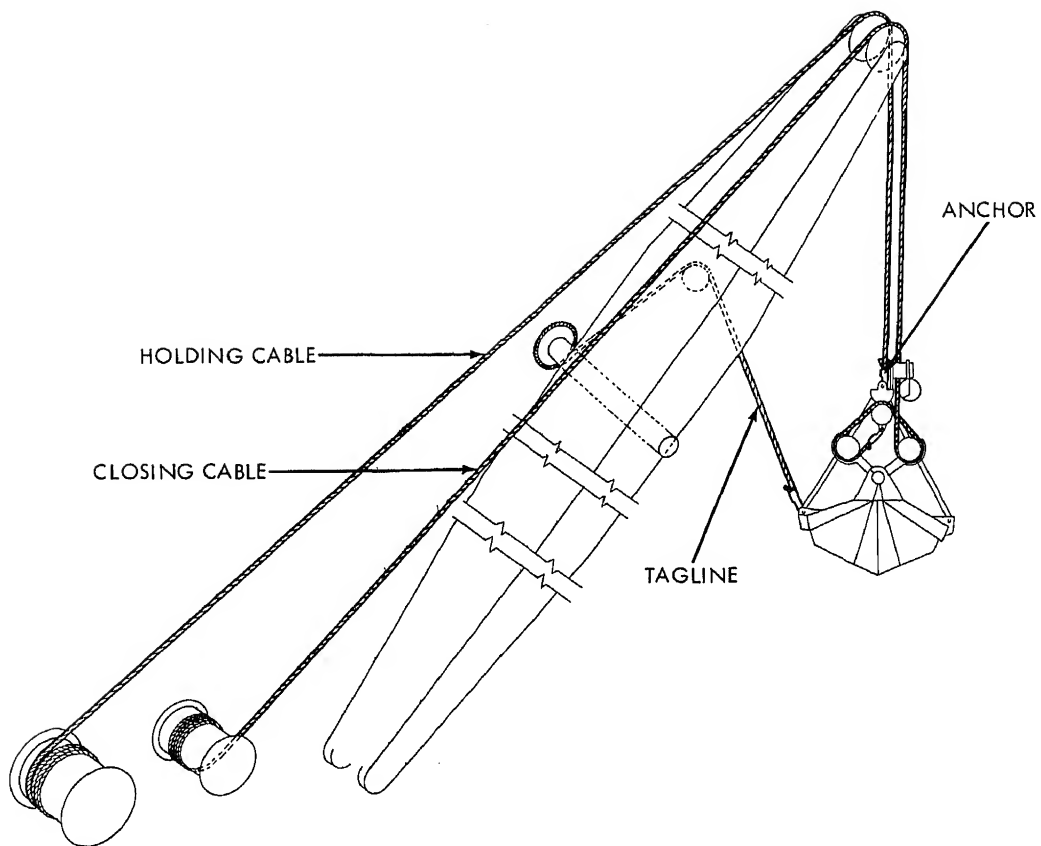
(a) Build cribbing to support shovel boom (fig. 2-22).

(b) Using a crane or suitable lifting device, place the shovel boom and dipper handle on the cribbing.

(c) Propel machine forward until boom foot enters lugs on revolving frame.

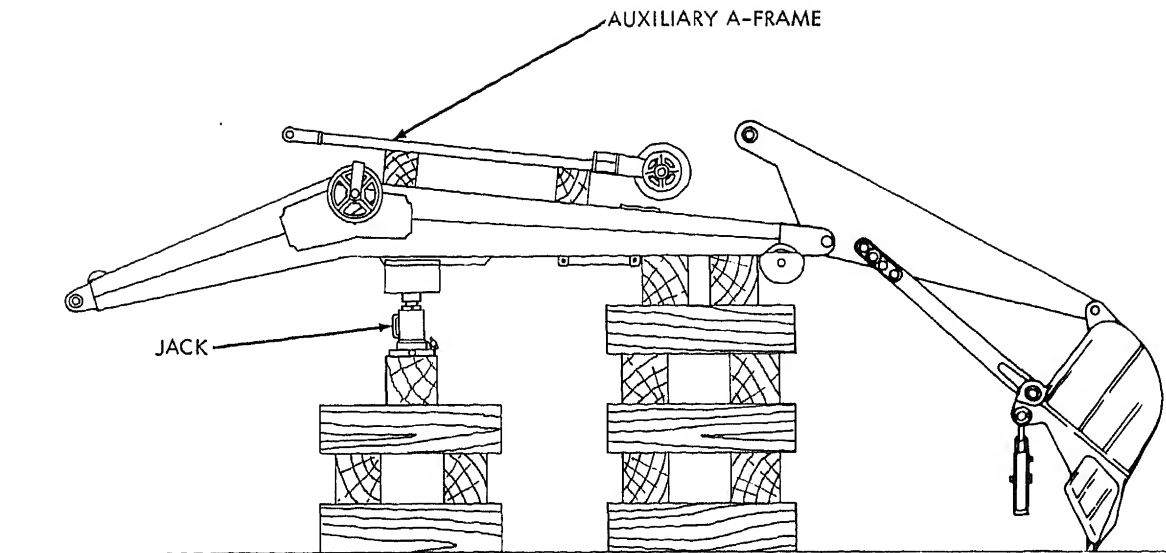
1. Raise or lower boom foot until it is aligned with boom foot lugs.

2. Install boom foot pins and locknuts.



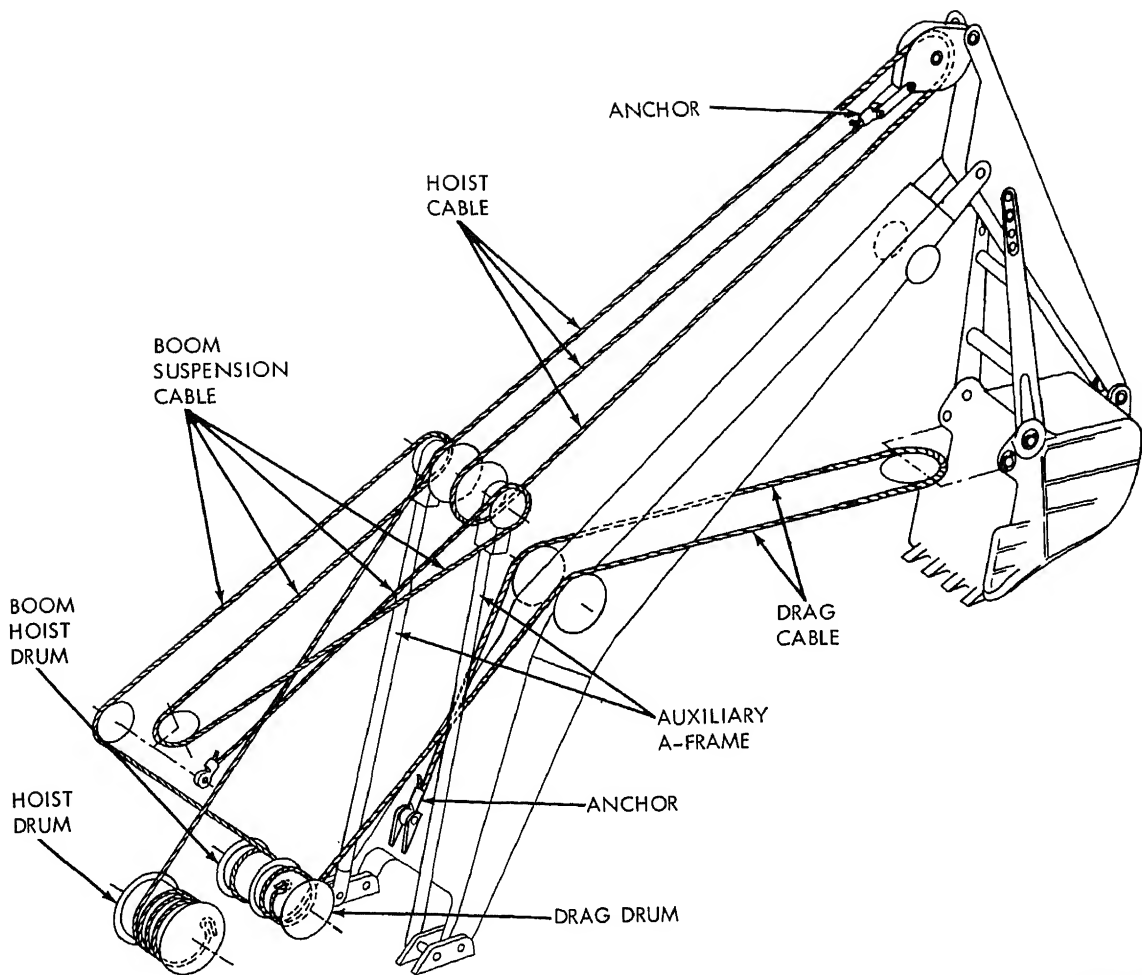
ME 3810-289-12

Figure 2-14. Clamshell cable reeving.



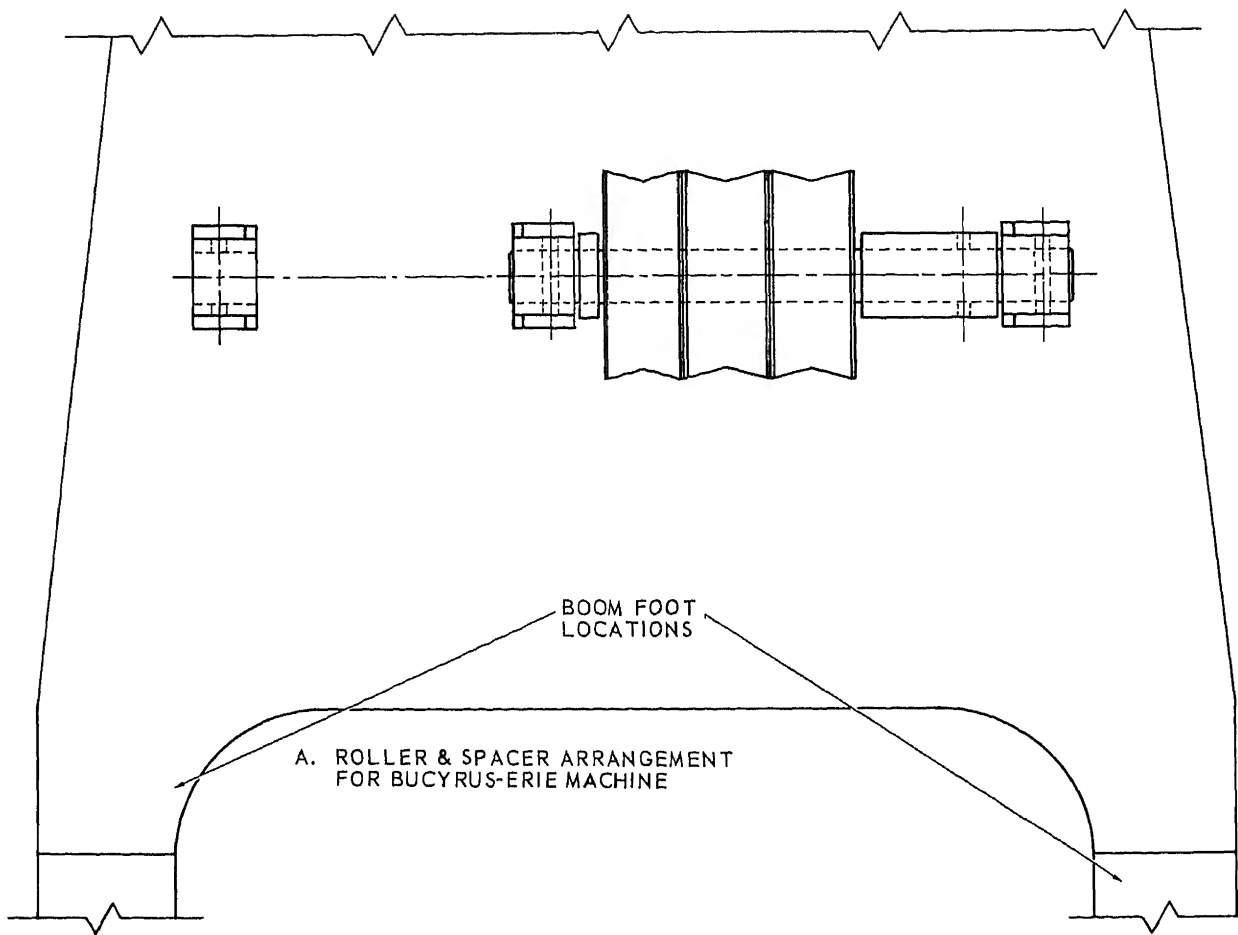
ME 3810-289-12/2-15

Figure 2-15. Backhoe boom support cribbing.



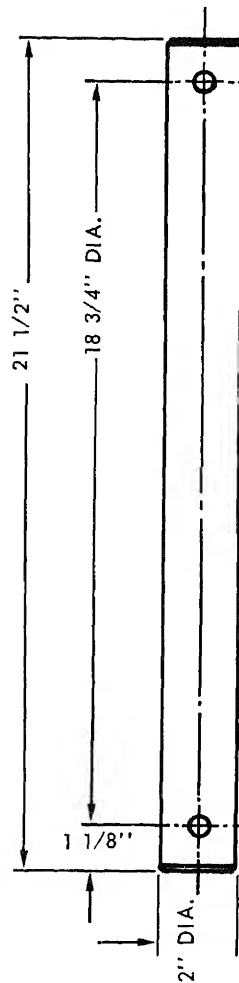
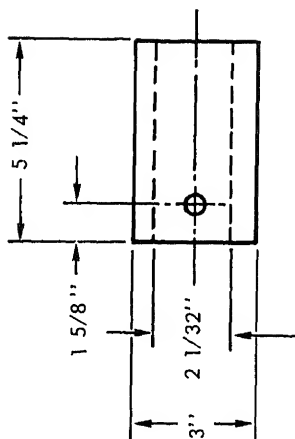
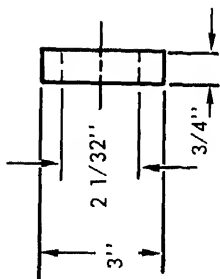
ME 3810-289-12/

Figure 2-16. Backhoe cable reeving.



ME 3810-289-12/ 2-1

Figure 2-17. Roller and spacer arrangement.



ME 3810-289-1

Figure 2-18. Roller assembly, shaft and spacers.

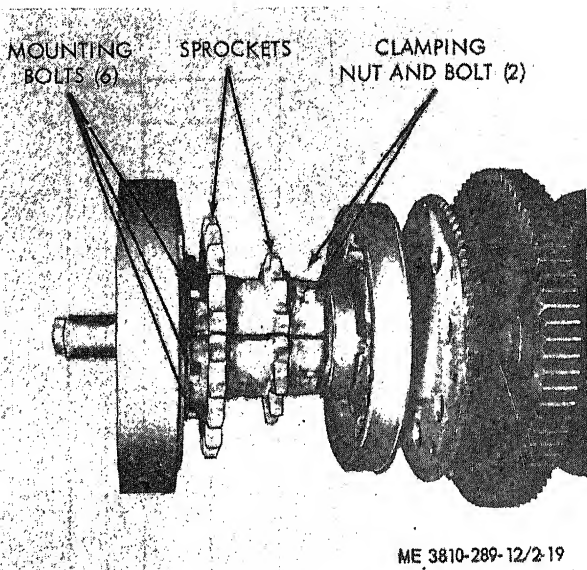


Figure 2-19. Crowd chain sprocket, removal and installation.

(a) Refer to table 4-3 for correct cable length.

(b) Lead cable (1) over left A-frame sheave and attach to boom hoist drum.

(c) Lead cable under left boom point sheave.

(d) Lead cable (2) around upper A-frame sheave and over right boom point sheave.

(e) Lead cable (4) over right A-frame sheave and under right boom point sheave.

(f) Lead cable (6) around lower A-frame sheave and over left boom point sheave.

(g) Attach cable (8) to anchor on A-frame.

(11) Boom raised to 45° angle. Refer to figure 2-23.

(12) Shovel cable reeving.

(a) Hoist (fig. 2-23).

(b) Crowd (fig. 2-23).

1. Refer to table 4-3 for correct cable length.

2. Remove cable guard on end of dipper handle.

3. Loop middle of cable over anchor casting.

4. Lead right end of cable down around shipper shaft drum, through lower section of boom to the right groove, and anchor in socket at right side of crowd drum.

5. Lead left end of cable down around shipper shaft drum, through lower section of boom to the left groove, and anchor in socket at left side of crowd drum.

6. Install cable guard and run handle all the way out until stops rest against saddle block.

(c) Backhaul (fig. 2-23)

1. Refer to table 4-3 for correct cable length.

2. Insert cable in drum socket.

3. Wind one wrap on center section of drum and attach.

4. Lead other end over top of center groove on shipper shaft drum and attach to adjusting bolt on dipper handle.

5. Turn nuts on adjustment bolt as tight as possible.

(d) Dipper trip (fig. 2-24).

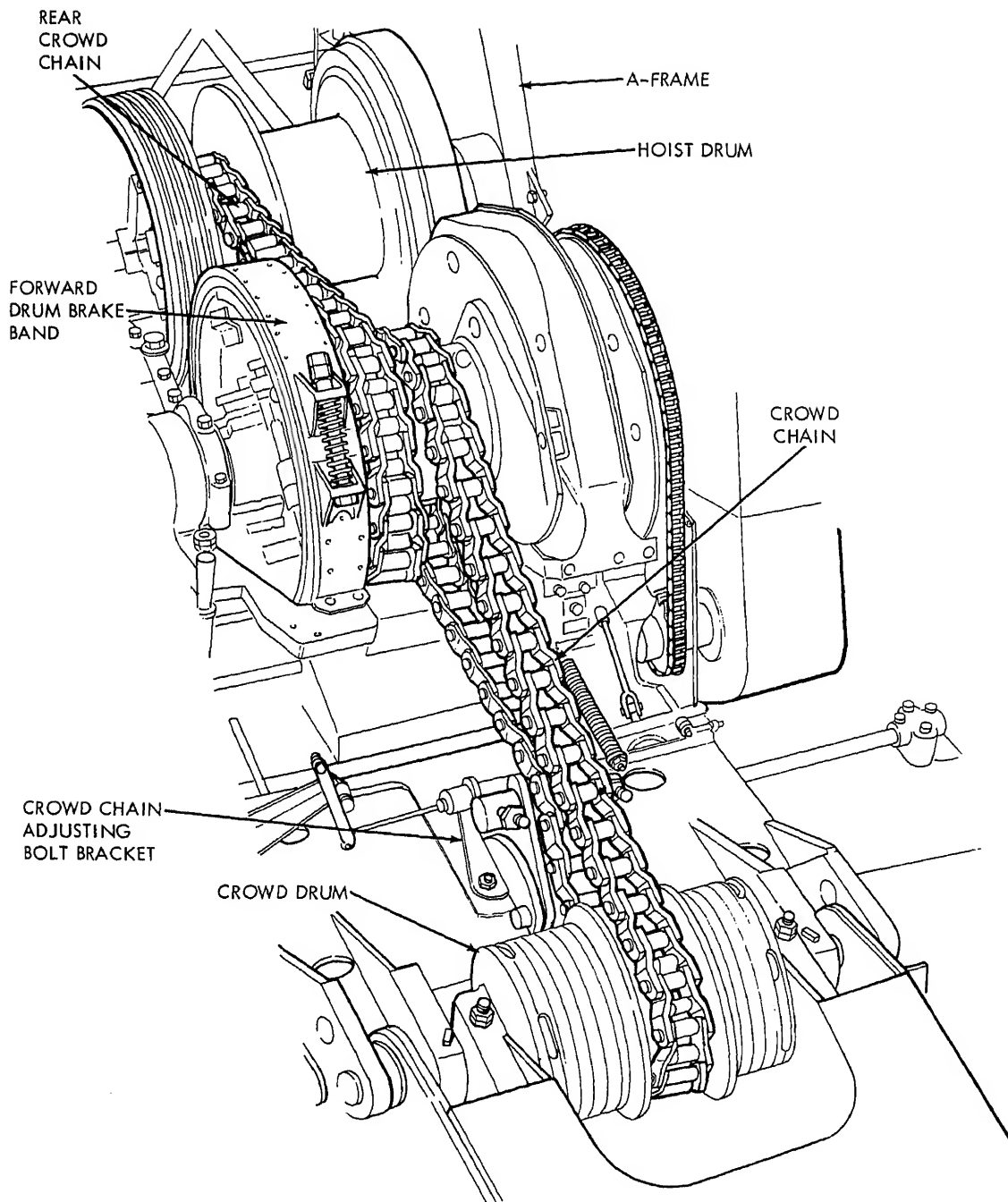
1. Lead end over sheave on right side of boom and through guide sheave located at boom foot on right side.

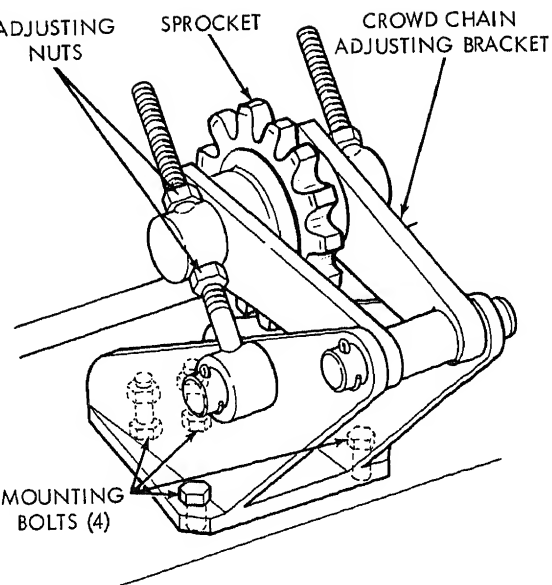
2. Lead cable under deck, around guide sheave, and attach to dipper trip drum.

3. Attach other end to drum lever at top of dipper.

(13) Adjustments.

(a) Dipper trip clutch (fig. 2-25).





ME 3810-289-12/2-21

Figure 2-21. Crowd chain adjusting bracket.

- (a) Back out nut.
- (b) Install washer(s) (6) behind spring (3).

4. Adjustment is correct if cable follows dipper handle without tripping dipper latch and toggle lever is free.

(b) Dipper.

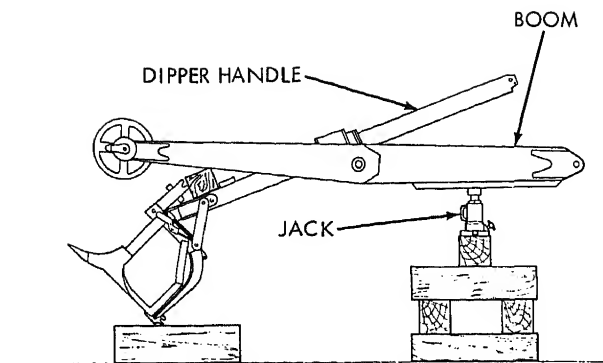
1. Dump chain (fig. 2-26).

- (a) Composed of two chains.
- (b) Length can be adjusted by changing position of pinch link.

2. Latch bar (fig. 2-26).

- (a) Make rough adjustment by changing dump chain length.

(b) Make fine adjustments by increasing or decreasing number of washers on fulcrum pin.



ME 3810-289-12/2-22

Figure 2-22. Shovel boom support cribbing.

(c) Backhaul cable (fig. 2-27).

1. Two inches is maximum allowable sag with dipper handle horizontal and fully extended with end of handle crowded against the saddle block.

2. Tighten the adjusting bolt until cable sag is within limits.

(d) Crowd chain (fig. 2-21).

- 1. Loosen locknuts.
- 2. Turn adjusting nuts until lower chain has approximately 2-inch sag when upper chain is tight.

3. Tighten locknuts.

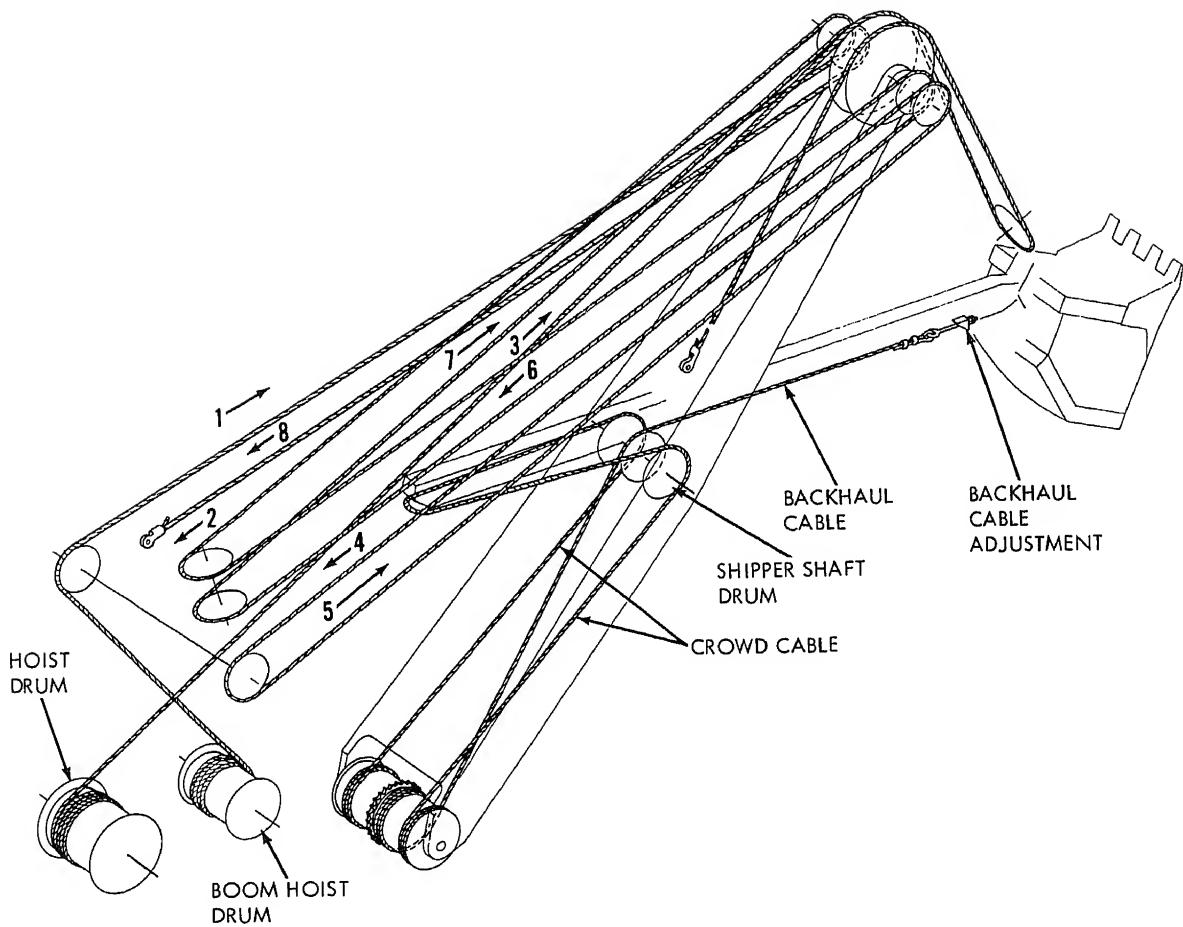
(e) Saddle block wearing plates (fig. 2-28).

- 1. Maximum allowable clearance between handle and wearing plates is $\frac{1}{8}$ inch.
- 2. Insert shims to adjust clearance.

(a) Raise dipper until handle is horizontal.

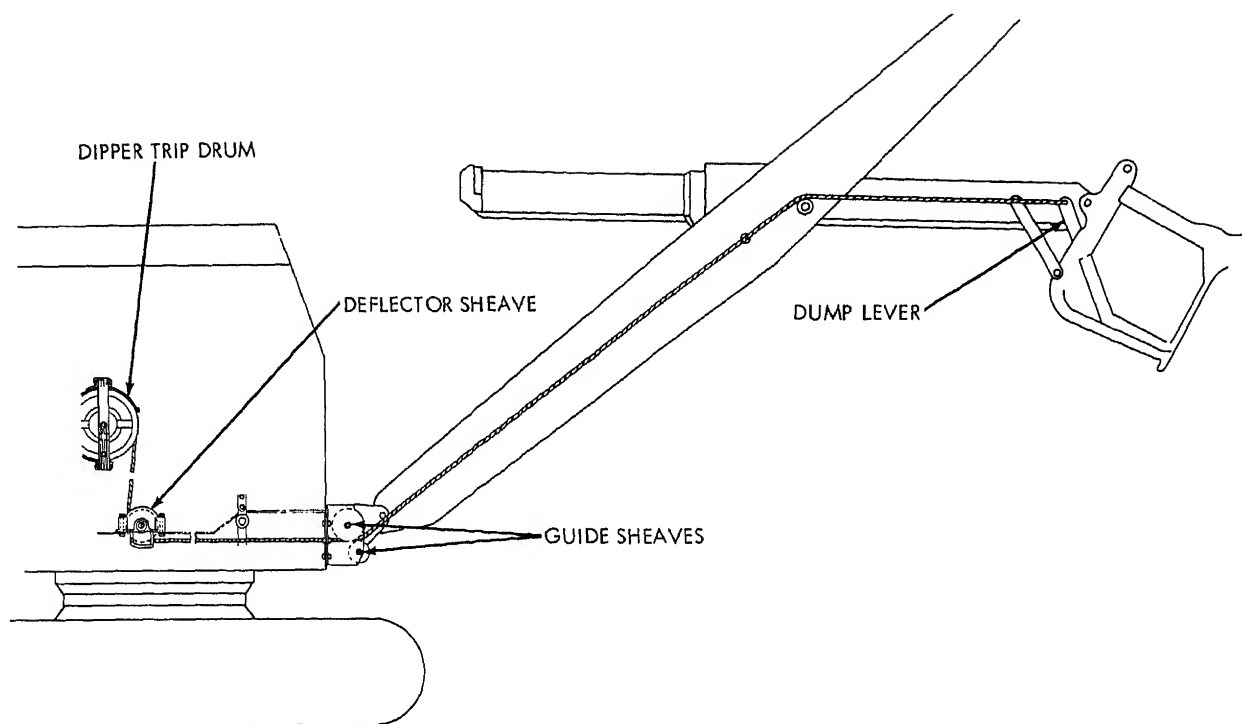
(b) Loosen capscrew, holding wearing plate, insert shims, and tighten capscrews.

(c) Clearance between wearing plate and handle on same side of saddle block must be maintained.



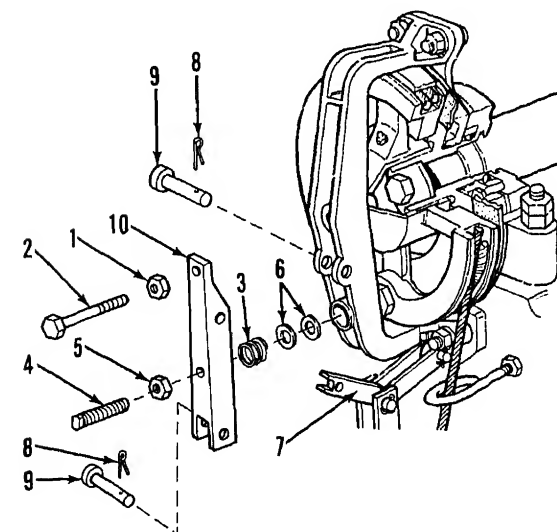
ME 3810-289-12/2-23

Figure 2-23. Shovel cable reeving.



ME 3810-289-12/2-24

Figure 2-24. Dipper trip cable reeving.



ME 3810-289-12/2-25

(1) Place lead sections on a flat surface in horizontal position resting on blocks or cribbing. Bolt corresponding (one top and four lower) sections together, using hardware listed in *d*, below.

(2) Lower boom to horizontal position in line with upper end of lead assembly and bolt securely to outside of adapter plates on boom point.

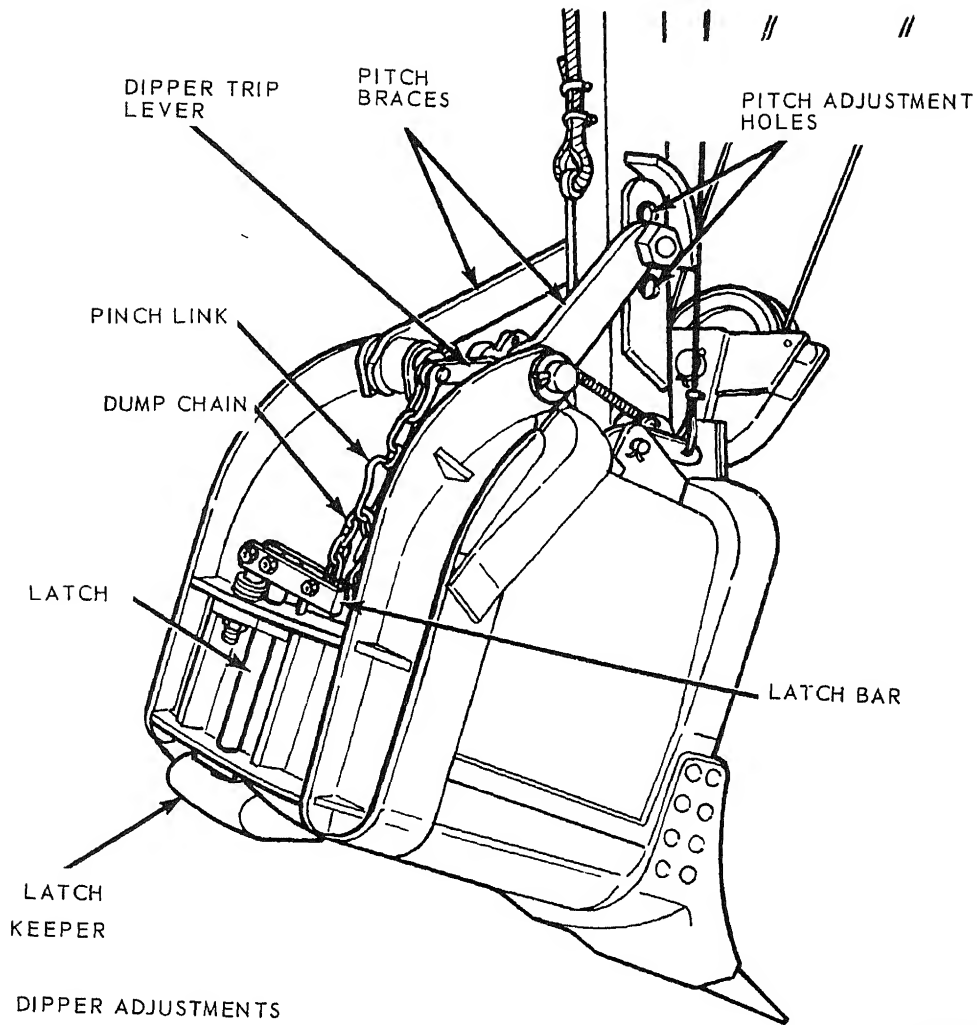
(3) Using boom hoist, raise boom and lead assembly to working position (fig. 2-29).

(4) Using hoist line, place hammer below leads and lower boom to enter hammer leads into hammer guides.

b. Catwalk Assembly.

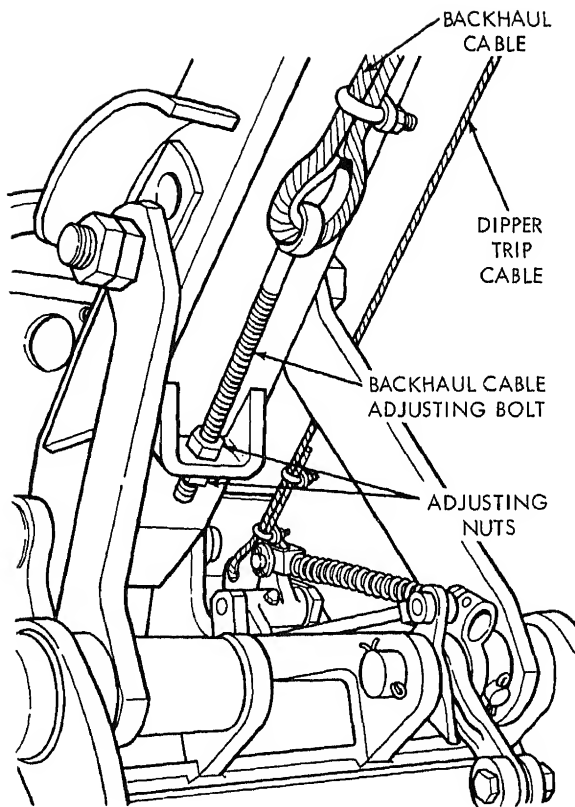
(1) Assemble two outer sections in horizontal position with inner or telescoping member between (fig. 2-29) and bolt loosely, using hardware listed in *d*, below.

(2) Hoist as a unit; bolt one end to boom



ME 3810-289-12

Figure 2-26. Dipper adjustment.



ME 3810-289-12/2-27

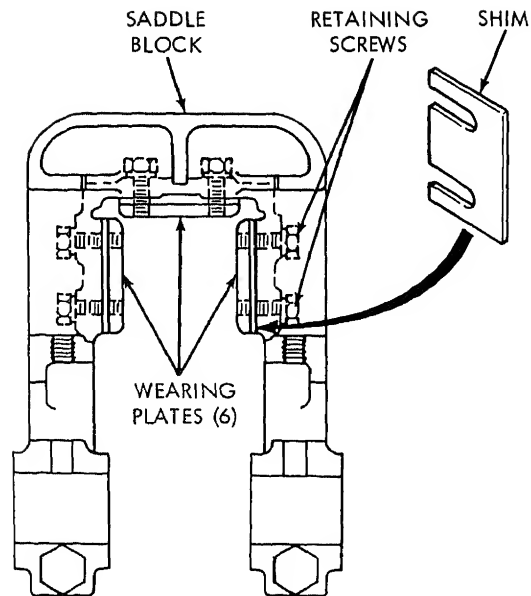
Figure 2-27. Backhaul cable adjustment.

c. Disassembly.

(1) To disassemble catwalk, reverse procedure in *b*, above.

(2) To disassemble lead sections, lower boom so lead assembly rests on ground. Back up machine and lower boom simultaneously, coordinating the two movements until lead assembly rests on blocks or ground.

d. List of Common Hardware (fig. 2-29).



ME 3810-289-12/2

Figure 2-28. Saddle block wearing plate adjustment.

(1) *Lead assembly top section (each).*

Twelve hexagon bolts, $\frac{3}{4}$ in. x 2 in. long

Twelve lockwashers

Twelve hexagon nuts, $\frac{3}{4}$ in.

Four hexagon bolts, $\frac{7}{8}$ in. x 3 in. long

Four lockwashers

Four hexagon nuts, $\frac{3}{4}$ in.

(2) *Lead assembly lower section (each).*

Sixteen hexagon bolts, $\frac{3}{4}$ in. x 2 in. long

Sixteen lockwashers

Sixteen hexagon nuts, $\frac{3}{4}$ in.

Four hexagon bolts, $\frac{7}{8}$ in. x 3 in. long

Four lockwashers

Four hexagon nuts, $\frac{3}{4}$ in.

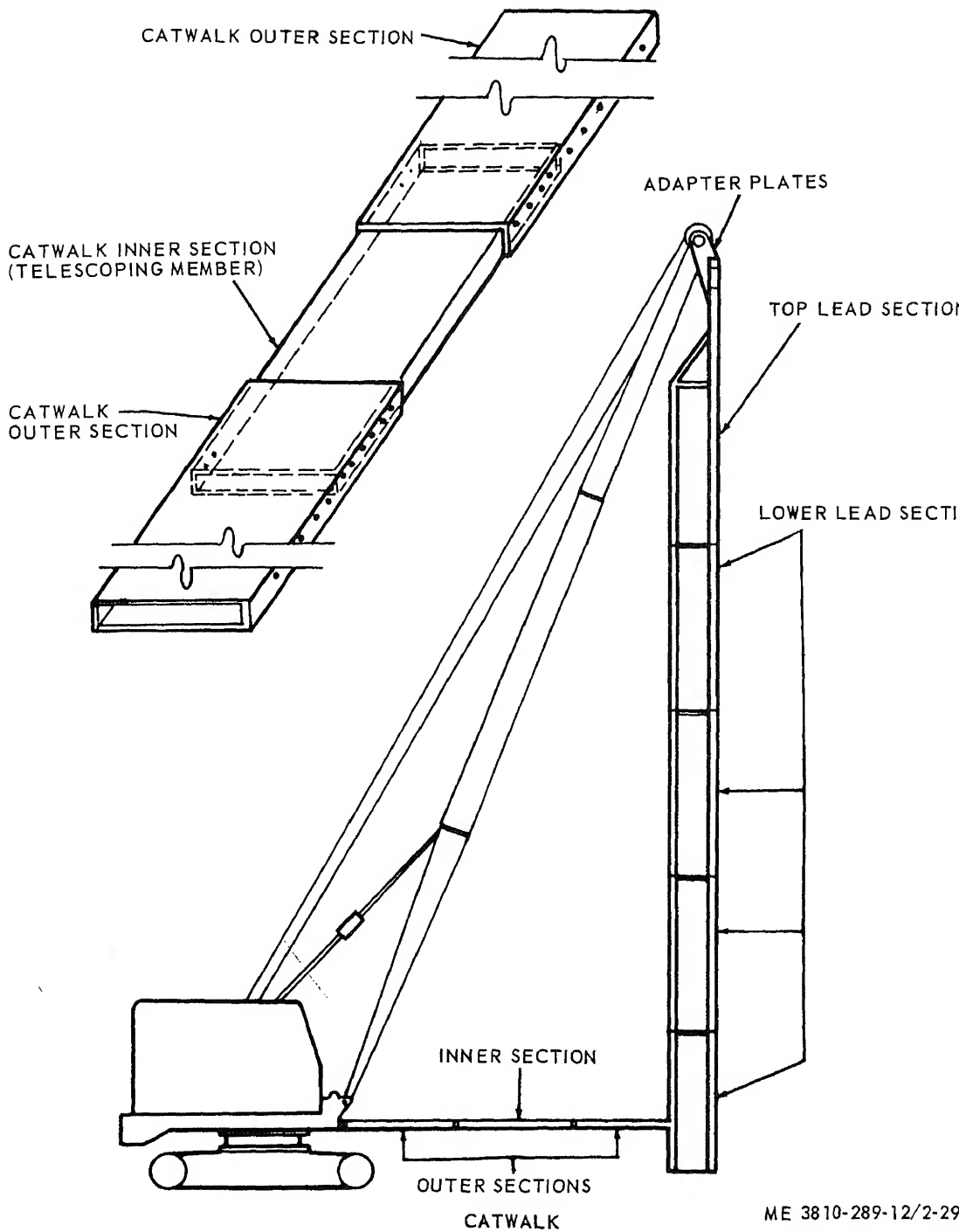
(3) *Catwalk assembly.*

Two square bolts, $\frac{1}{2}$ in. x $26\frac{1}{2}$ in. long

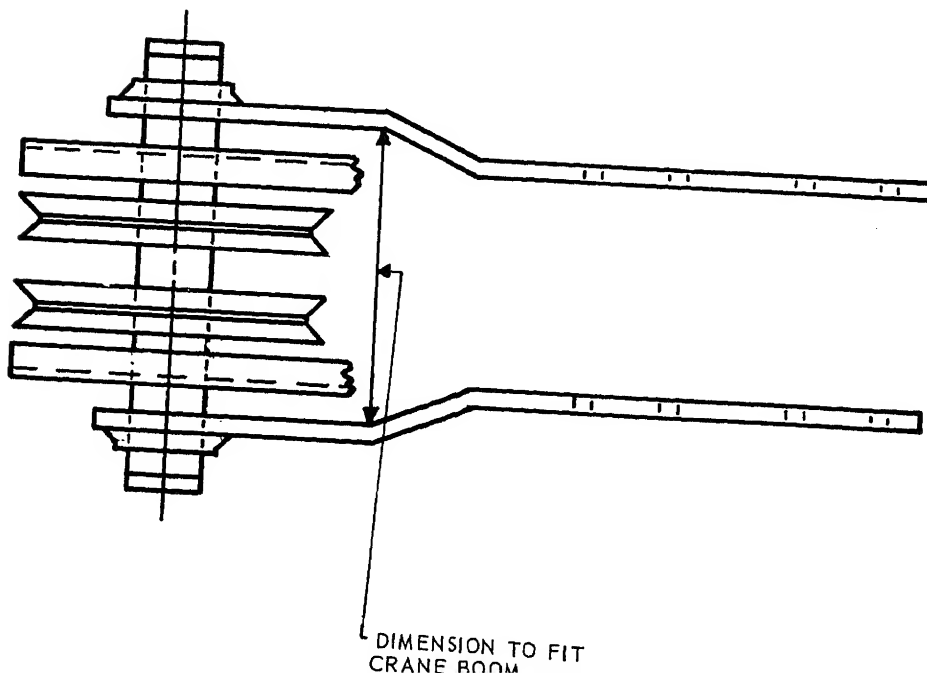
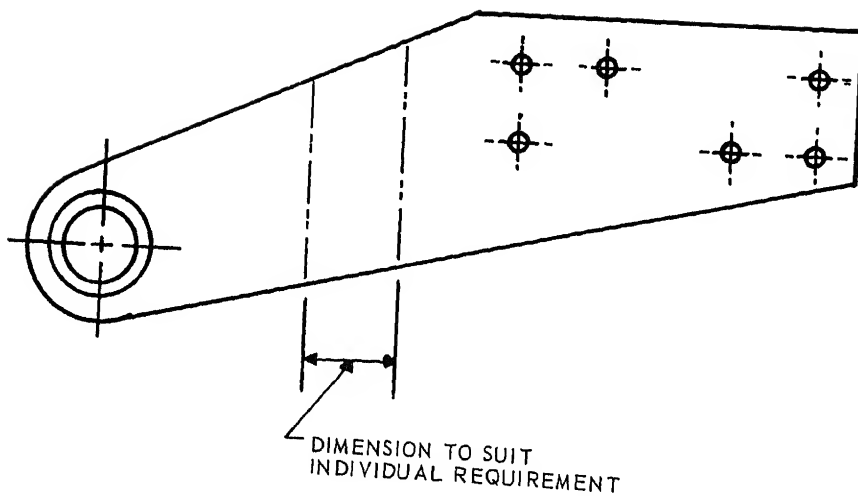
Eight hexagon bolts, $\frac{1}{2}$ in. x 2 in. long

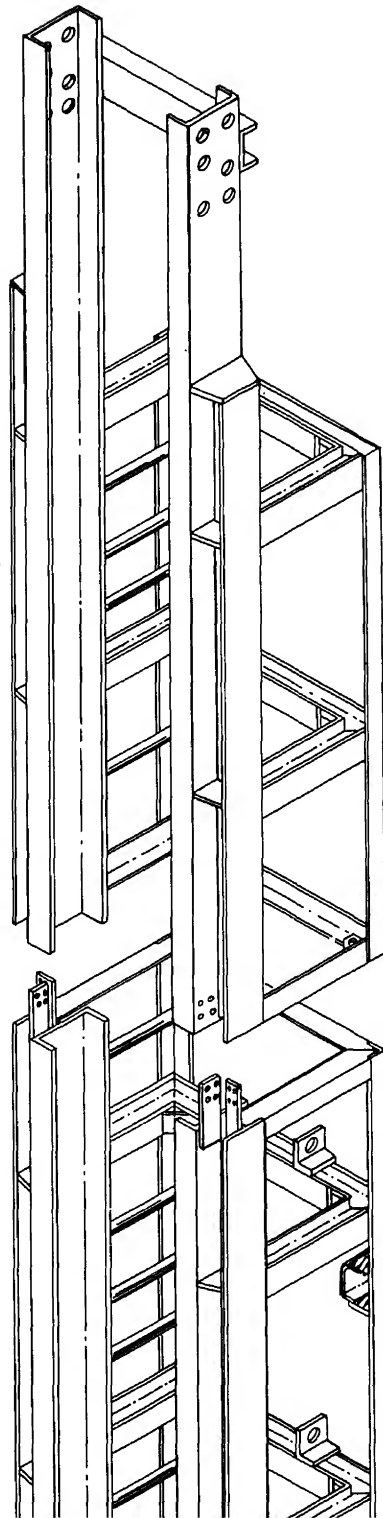
Ten lockwashers

Ten hexagon nuts, $\frac{1}{2}$ in.



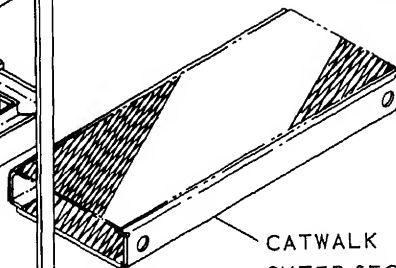
PILE DRIVER LEAD ADAPTER



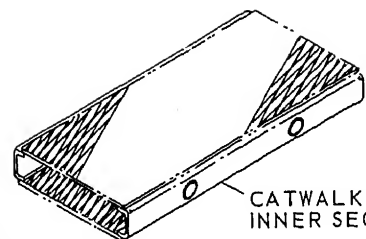


TOP LEAD
SECTION

LOWER LEAD
SECTION



CATWALK
OUTER SECTION



CATWALK
INNER SE



BOLT

Section II. MOVEMENT TO NEW WORKSITE

2-10. Dismantling and Movement

a. *General.* When it is necessary to move the crane-shovel to another worksite, it may be driven under its own power, or it may be transported by truck, rail, or air. Method of movement will depend on destination and distance involved.

b. *Movement Short Distance.* The crane-shovel is not dismantled when moved a short distance under its own power. Proceed as follows:

(1) Perform preventive maintenance checks and services (para 3-6).

(2) Make sure all tools and equipment to be moved with the crane-shovel are clean, serviceable, and properly stowed.

(3) Start engine (para 2-15) and drive crane-shovel to new worksite.

c. *Short Distance Movement by Carrier.* For short distance moves by trailer or railroad car, the upper boom section can be removed and stacked on top of the lower section (fig. 2-30). The counterweight should be supported by an A-frame of wood timber (fig. 2-31).

d. *Dismantling for Long Distance Movement.* Refer to the appropriate paragraphs in chapter 4 and remove the front end attachment.

e. *Loading by Drive-On.*

(1) Refer to paragraph 2-15 and start engine.

(2) Drive crane-shovel slowly and couple up ramp onto carrier.

f. *Loading by Lifting.*

(1) Position adequate lifting device on carrier.

(2) Place lifting slings over lifting hook and attach to crane-shovel lifting eye (2-2).

(3) Attach a tagline to keep crane from twisting or turning during lifting process.

Warning: Keep all personnel not engaged in loading procedure back and away from crane area to avoid injury, should slings break during lift.

Caution: Do not allow crane-shovel to twist during lift. The added stress on lift might cause them to break and drop crane, causing extensive damage to the equipment.

(4) Lift crane-shovel (on signal) and move it over carrier and lower to position for transport.

2-11. Reinstallation After Movement

For installation after movement to a new site, refer to paragraphs 2-2 and 2-3.

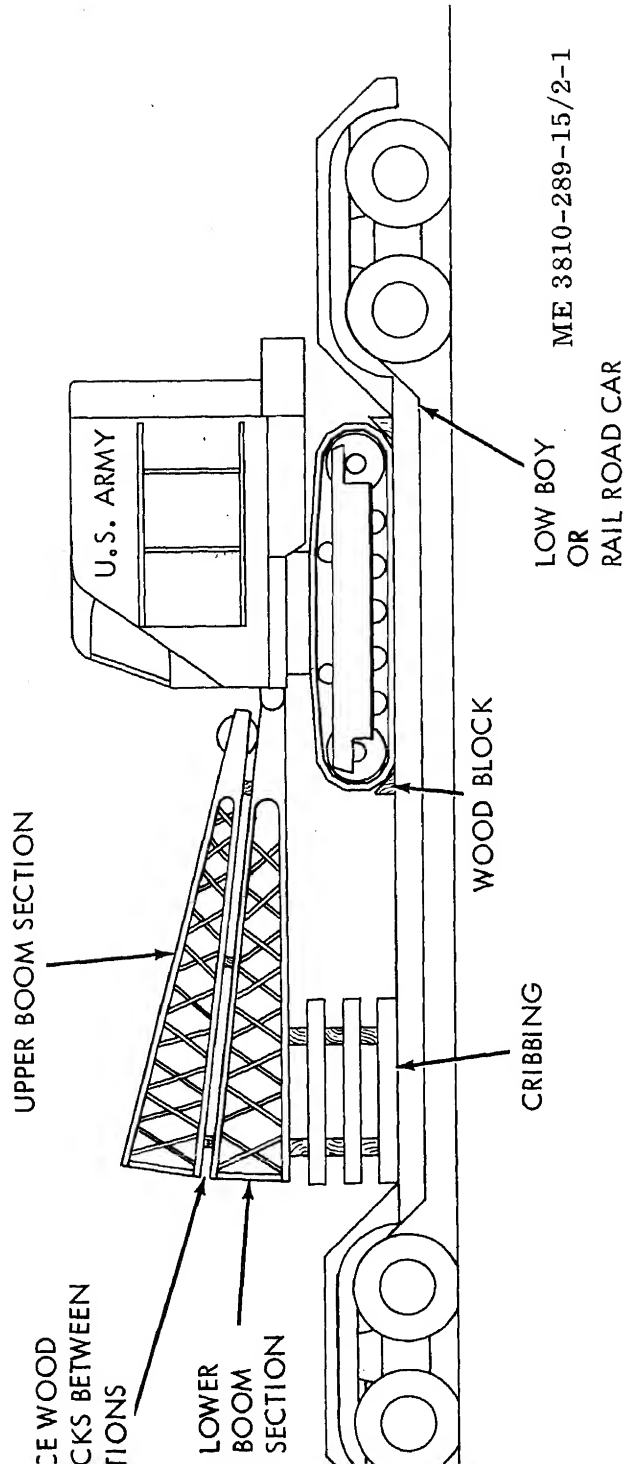
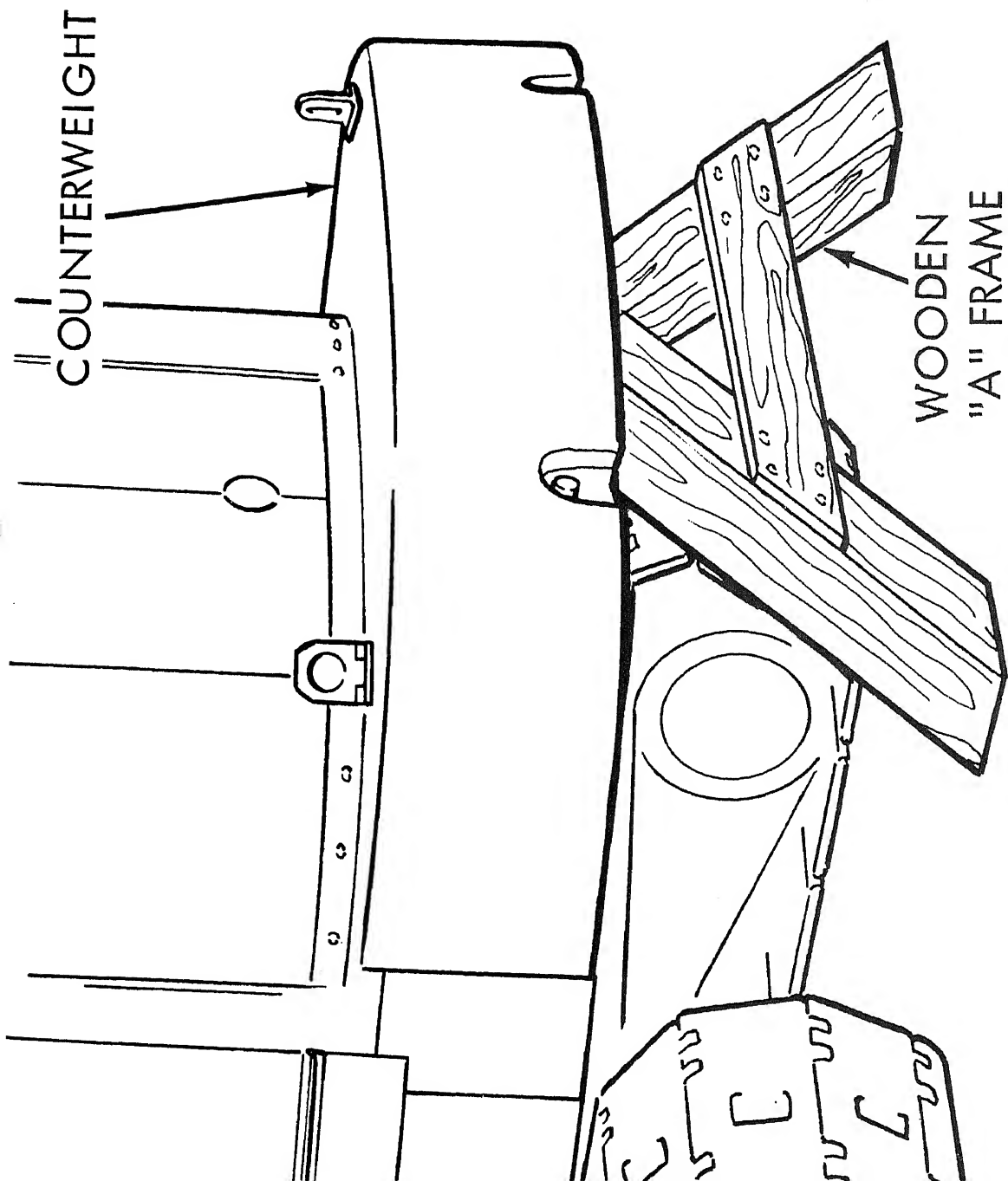


Figure 2-30. Crane-shovel mounted on trailer.



Section III. CONTROLS AND INSTRUMENTS

2. General

This section describes, locates, illustrates, and identifies operator, crew, or organizational maintenance personnel sufficient information about various controls and instruments for proper operation of the model 22BM crane-shovel.

2-13. Controls and Instruments

The purpose of controls and instruments and their normal and maximum reading are illustrated in figures 2-32 through 2-37.

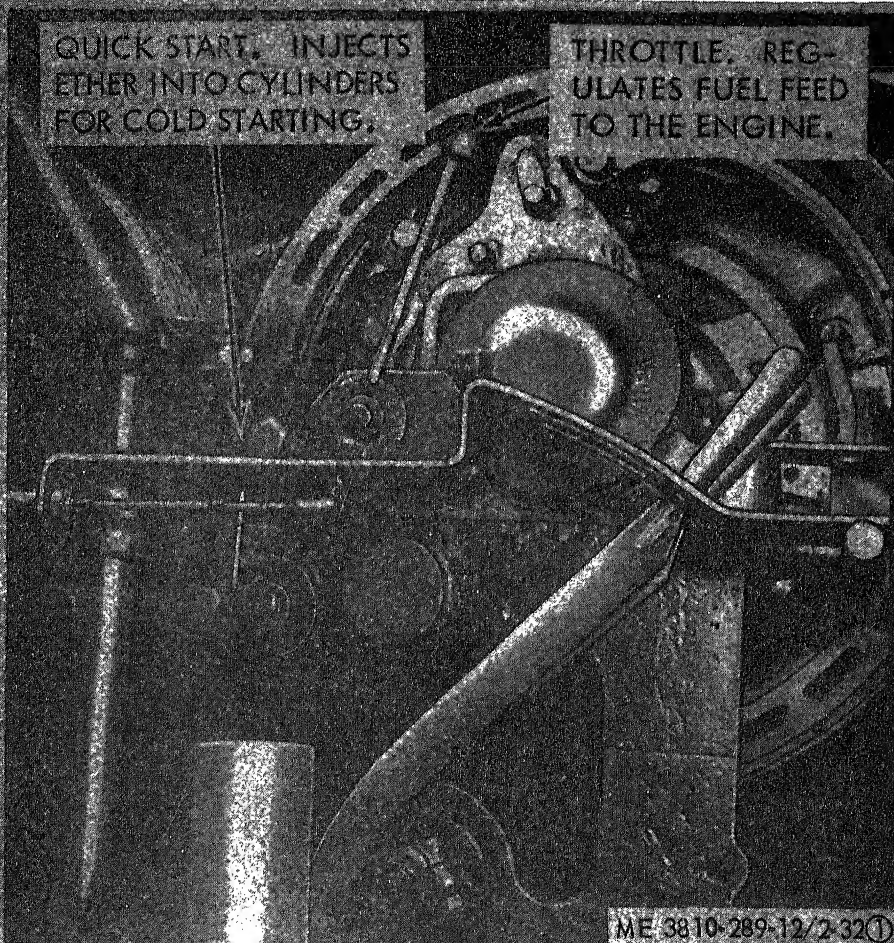
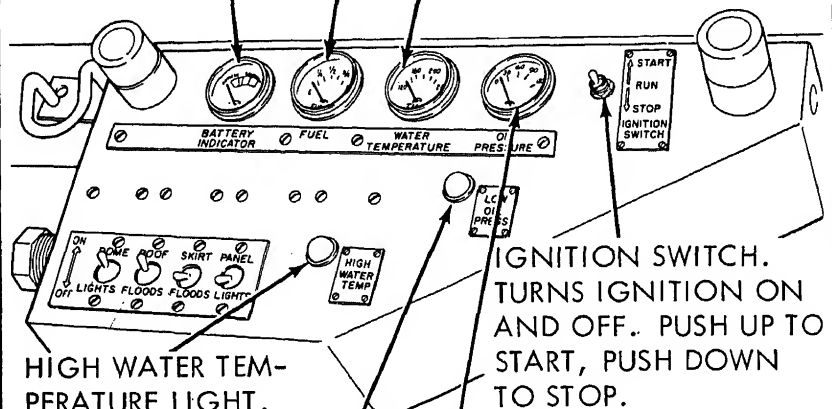


Figure 2-32. Engine controls and instruments (sheet 1 of 2).

BATTERY INDICATOR. INDICATES WHETHER THE BATTERY IS RECEIVING OR DISCHARGING CURRENT. UNDER NORMAL CONDITIONS IT SHOULD INDICATE A SLIGHT CHARGE.

FUEL GAGE. INDICATES AMOUNT OF FUEL IN THE FUEL TANK.

WATER TEMPERATURE GAGE. INDICATES TEMPERATURE OF THE WATER IN THE COOLING SYSTEM.



HIGH WATER TEMPERATURE LIGHT. COMES ON WHEN THE WATER TEMPERATURE GETS ABOVE 210°F.

LOW OIL PRESSURE LIGHT. COMES ON WHEN THE OIL PRESSURE GETS BELOW 10 psi.

OIL PRESSURE GAGE. INDICATES AMOUNT OF OIL PRESSURE IN THE SUPPLY LINES OF THE ENGINE CRANKCASE. NORMAL READING IS AROUND 40 psi.

IGNITION SWITCH. TURNS IGNITION ON AND OFF. PUSH UP TO START, PUSH DOWN TO STOP.

DRIVE-CHAIN END. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO SWING RIGHT OR TO PROPEL TOWARD DRIVE CHAIN END.

MAIN ENGINE CLUTCH LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO ENGAGE.

SWING LOCK LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO LOCK.

BOOM-HOIST SAFETY PAWL LEVER. PULL UP TO RELEASE; PUSH DOWN TO LOCK.

DIGGING LOCK LEVER. PUSH FORWARD TO LOCK BOTH WAYS. MIDDLE POSITION IS TO LOCK ONE WAY. PULL BACK TO RELEASE BOTH WAYS.

SWING-PROPEL SPLINE CLUTCH LEVER. PUSH FORWARD FOR PROPEL POSITION. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK FOR SWING POSITION.

REAR DRUM (SECONDARY HOIST) BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

HOIST BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

POSITION IS TO STEER STRAIGHT AHEAD. PULL BACK TO STEER LEFT (WITH DRIVE CHAINS REAR).

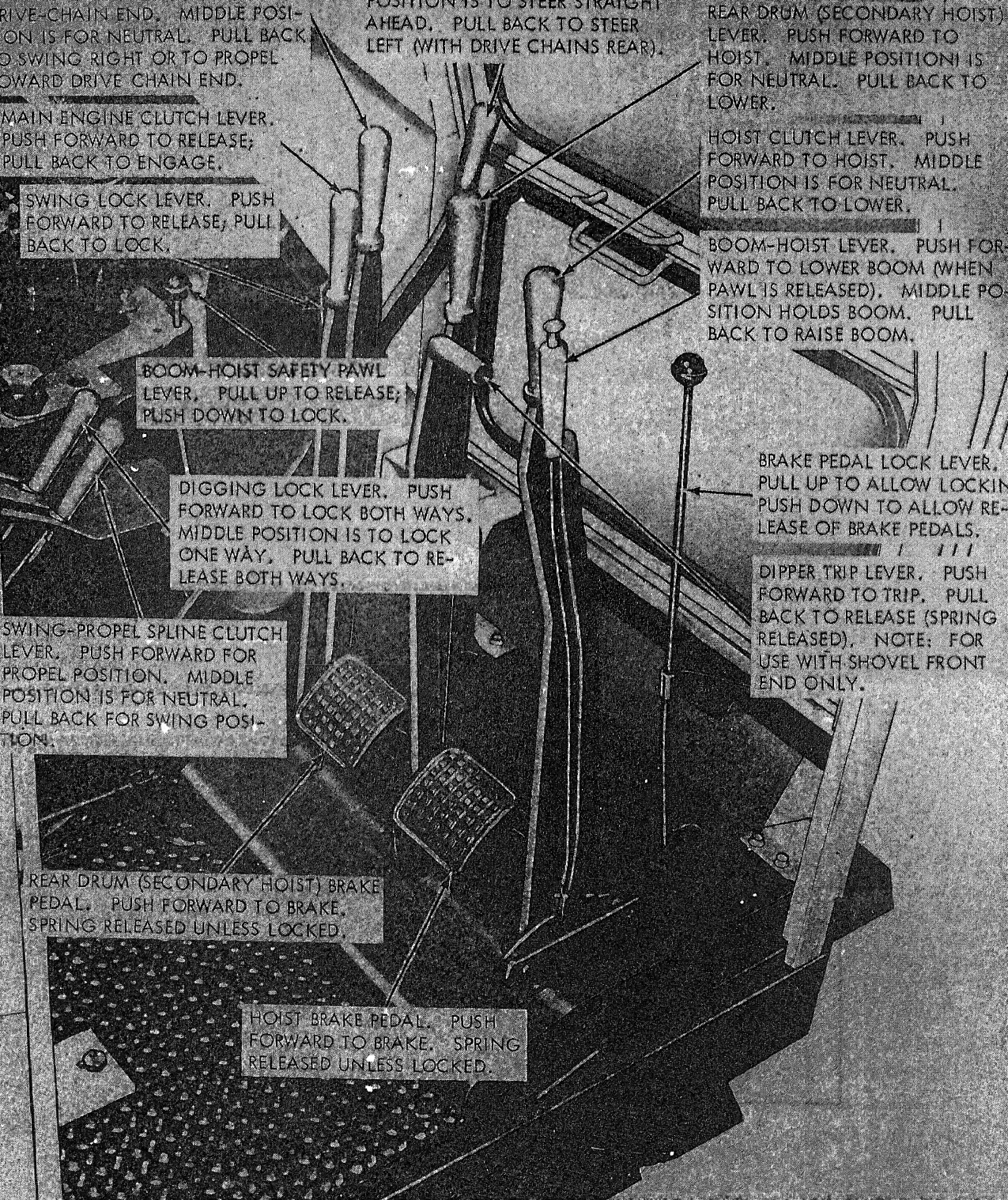
REAR DRUM (SECONDARY HOIST) LEVER. PUSH FORWARD TO HOIST. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO LOWER.

HOIST CLUTCH LEVER. PUSH FORWARD TO HOIST. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO LOWER.

BOOM-HOIST LEVER. PUSH FORWARD TO LOWER BOOM (WHEN PAWL IS RELEASED). MIDDLE POSITION HOLDS BOOM. PULL BACK TO RAISE BOOM.

BRAKE PEDAL LOCK LEVER. PULL UP TO ALLOW LOCKING. PUSH DOWN TO ALLOW RELEASE OF BRAKE PEDALS.

DIPPER TRIP LEVER. PUSH FORWARD TO TRIP. PULL BACK TO RELEASE (SPRING RELEASED). NOTE: FOR USE WITH SHOVEL FRONT END ONLY.



DRIVE-CHAIN END. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO SWING RIGHT OR TO PROPEL TOWARD DRIVE CHAIN END.

AHEAD. PULL BACK TO STEER LEFT (WITH DRIVE CHAINS REAR).

MAIN ENGINE CLUTCH LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO ENGAGE.

SWING LOCK LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO LOCK.

BOOM-HOIST SAFETY PAWL LEVER. PULL UP TO RELEASE; PUSH DOWN TO LOCK.

DIGGING LOCK LEVER. PUSH FORWARD TO LOCK BOTH WAYS. MIDDLE POSITION IS TO LOCK ONE WAY. PULL BACK TO RELEASE BOTH WAYS.

SWING-PROPEL SPLINE CLUTCH LEVER. PUSH FORWARD FOR PROPEL POSITION. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK FOR SWING POSITION.

DRAG BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

HOIST BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

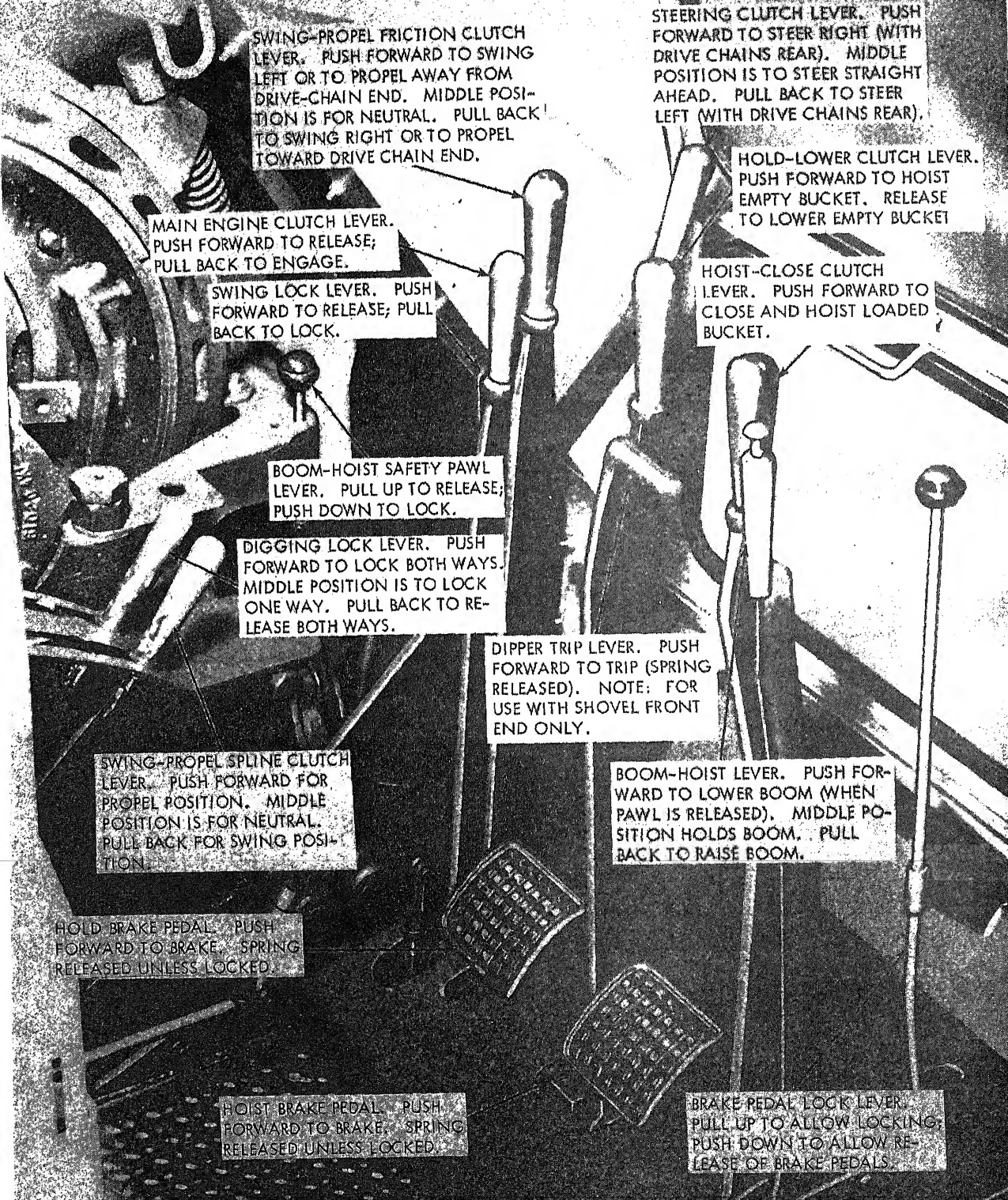
DRAG CLUTCH LEVER. PUSH FORWARD TO DRAG. PULL BACK TO RELEASE TO SWING BUCKET OUT UNDER BOOM POINT.

HOIST CLUTCH LEVER. PUSH FORWARD TO HOIST. MIDDLE POSITION IS FOR NEUTRAL.

DIPPER TRIP LEVER. PUSH FORWARD TO TRIP (SPRING RELEASED). NOTE: FOR USE WITH SHOVEL FRONT END ONLY.

BOOM-HOIST LEVER. PUSH FORWARD TO LOWER BOOM (WHEN PAWL IS RELEASED). MIDDLE POSITION HOLDS BOOM. PULL BACK TO RAISE BOOM.

BRAKE PEDAL LOCK LEVER. PULL UP TO ALLOW LOCKING; PUSH DOWN TO ALLOW RELEASE OF BRAKE PEDALS.



SWING-PROPEL FRICTION CLUTCH LEVER. PUSH FORWARD TO SWING LEFT OR TO PROPEL AWAY FROM DRIVE-CHAIN END. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO SWING RIGHT OR TO PROPEL TOWARD DRIVE CHAIN END.

MAIN ENGINE CLUTCH LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO ENGAGE.

SWING LOCK LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO LOCK.

BOOM-HOIST SAFETY PAWL LEVER. PULL UP TO RELEASE; PUSH DOWN TO LOCK.

DIGGING LOCK LEVER. PUSH FORWARD TO LOCK BOTH WAYS. MIDDLE POSITION IS TO LOCK ONE WAY. PULL BACK TO RELEASE BOTH WAYS.

SWING-PROPEL SPLINE CLUTCH LEVER. PUSH FORWARD FOR PROPEL POSITION. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK FOR SWING POSITION.

HOLD BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

HOIST BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

STEERING CLUTCH LEVER. PUSH FORWARD TO STEER RIGHT (WITH DRIVE CHAINS REAR). MIDDLE POSITION IS TO STEER STRAIGHT AHEAD. PULL BACK TO STEER LEFT (WITH DRIVE CHAINS REAR).

HOLD-LOWER CLUTCH LEVER. PUSH FORWARD TO HOIST EMPTY BUCKET. RELEASE TO LOWER EMPTY BUCKET.

HOIST-CLOSE CLUTCH LEVER. PUSH FORWARD TO CLOSE AND HOIST LOADED BUCKET.

DIPPER TRIP LEVER. PUSH FORWARD TO TRIP (SPRING RELEASED). NOTE: FOR USE WITH SHOVEL FRONT END ONLY.

BOOM-HOIST LEVER. PUSH FORWARD TO LOWER BOOM (WHEN PAWL IS RELEASED). MIDDLE POSITION HOLDS BOOM. PULL BACK TO RAISE BOOM.

BRAKE PEDAL LOCK LEVER. PULL UP TO ALLOW LOCKING; PUSH DOWN TO ALLOW RELEASE OF BRAKE PEDALS.

DRIVE-CHAIN END. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO SWING RIGHT OR TO PROPEL TOWARD DRIVE CHAIN END.

MAIN ENGINE CLUTCH LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO ENGAGE.

SWING LOCK LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO LOCK.

BOOM-HOIST SAFETY PAWL LEVER. PULL UP TO RELEASE; PUSH DOWN TO LOCK.

DIGGING LOCK LEVER. PUSH FORWARD TO LOCK BOTH WAYS. MIDDLE POSITION IS TO LOCK ONE WAY. PULL BACK TO RELEASE BOTH WAYS.

SWING-PROPEL SPLINE CLUTCH LEVER. PUSH FORWARD FOR PROPEL POSITION. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK FOR SWING POSITION.

DRAG BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

HOIST BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

POSITION IS TO STEER STRAIGHT AHEAD. PULL BACK TO STEER LEFT (WITH DRIVE CHAINS REAR).

DRAG CLUTCH LEVER. PUSH FORWARD TO DRAG DIPPER IN. USE HOIST CLUTCH TO RUN DIPPER OUT.

HOIST CLUTCH LEVER. PUSH FORWARD TO HOIST. RELEASE BRAKE TO LOWER.

BOOM-HOIST LEVER. PUSH FORWARD TO LOWER BOOM (WHEN PAWL IS RELEASED). MIDDLE POSITION HOLDS BOOM. PULL BACK TO RAISE BOOM.

BRAKE PEDAL LOCK LEVER. PULL UP TO ALLOW LOCKING; PUSH DOWN TO ALLOW RELEASE OF BRAKE PEDALS.

DRIVE CHAIN END. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO SWING RIGHT OR TO PROPEL TOWARD DRIVE CHAIN END.

POSITION IS TO STEER STRAIGHT AHEAD. PULL BACK TO STEER LEFT (WITH DRIVE CHAINS REAR).

MAIN ENGINE CLUTCH LEVER. PUSH FORWARD TO RELEASE. PULL BACK TO ENGAGE.

BOOM-HOIST SAFETY PAWL LEVER. PULL UP TO RELEASE; PUSH DOWN TO LOCK.

SWING LOCK LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO LOCK.

DIGGING LOCK LEVER. PUSH FORWARD TO LOCK BOTH WAYS. MIDDLE POSITION IS TO LOCK ONE WAY. PULL BACK TO RELEASE BOTH WAYS.

SWING-PROPEL SPLINE CLUTCH LEVER. PUSH FORWARD FOR PROPEL POSITION. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK FOR SWING POSITION.

CROWD BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

HOIST BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

CROWD CLUTCH LEVER. PUSH FORWARD TO CROWD OUT. MIDDLE IS FOR NEUTRAL. PULL BACK TO RETRACT.

HOIST CLUTCH LEVER. PUSH FORWARD TO HOIST DIPPER.

DIPPER TRIP LEVER. PUSH FORWARD TO TRIP. PULL BACK TO RELEASE (SPRING RELEASED). NOTE: FOR USE WITH SHOVEL FRONT END ONLY.

BOOM-HOIST LEVER. PUSH FORWARD TO LOWER BOOM (WHEN PAWL IS RELEASED). MIDDLE POSITION HOLDS BOOM. PULL BACK TO RAISE BOOM.

BRAKE PEDAL LOCK LEVER. PULL UP TO ALLOW LOCKING; PUSH DOWN TO ALLOW RELEASE OF BRAKE PEDALS.

Section IV. OPERATION UNDER USUAL CONDITIONS

4. General

Instructions in this section are published for information and guidance of personnel responsible for operation of the crane-shovel.

The operator must know how to perform every operation of which the crane-shovel is capable. This section gives instructions on starting and stopping the crane-shovel, basic motions of the crane-shovel, and on coordinating motions to perform specific tasks for which the equipment is designed. Since nearly every job presents a different problem, the operator may have to vary given procedures to fit the individual

5. Starting

Preparation for Starting.

(1) Perform necessary daily preventive maintenance services (para 3-6).

(2) Check load requirements.

Starting. Refer to figure 2-38 and start the crane-shovel.

6. Stopping

Refer to figure 2-39 and stop the crane-shovel.

Perform the necessary daily preventive maintenance operations (para 3-6).

7. Operation of Crane

General.

(1) Be sure the boom length and boom angle are such that the load to be lifted comes within the limit given in the table of maximum allowable lifting loads (para 1-5b, (9)).

(2) Crane ratings are based on a firm and level foundation for the crane and if the footing is soft enough so that the crane will sink in to any

(5) If necessary to propel with the load suspended, snub it to the foot of the boom to prevent it swinging out beyond the boom point.

(6) Keep the load as low as possible and use extreme care when traveling with a high boom.

(7) Use the auxiliary hoist line for light loads only.

(8) Be sure hoist and boom suspension cables are in good condition before making any heavy lifts.

(9) Use the boom hoist to change the boom angle for accurately spotting the load, but avoid using the boom hoist with heavy loads suspended.

b. Operation.

(1) Start the crane-shovel (para 2-15).

(2) Refer to figures 2-40 through 2-44 to operate the crane.

2-18. Operation of Dragline

a. General.

(1) Work with boom at highest angle that will allow the reach and accuracy needed for the particular job.

(2) Avoid pulling the drag cable socket into the fairlead.

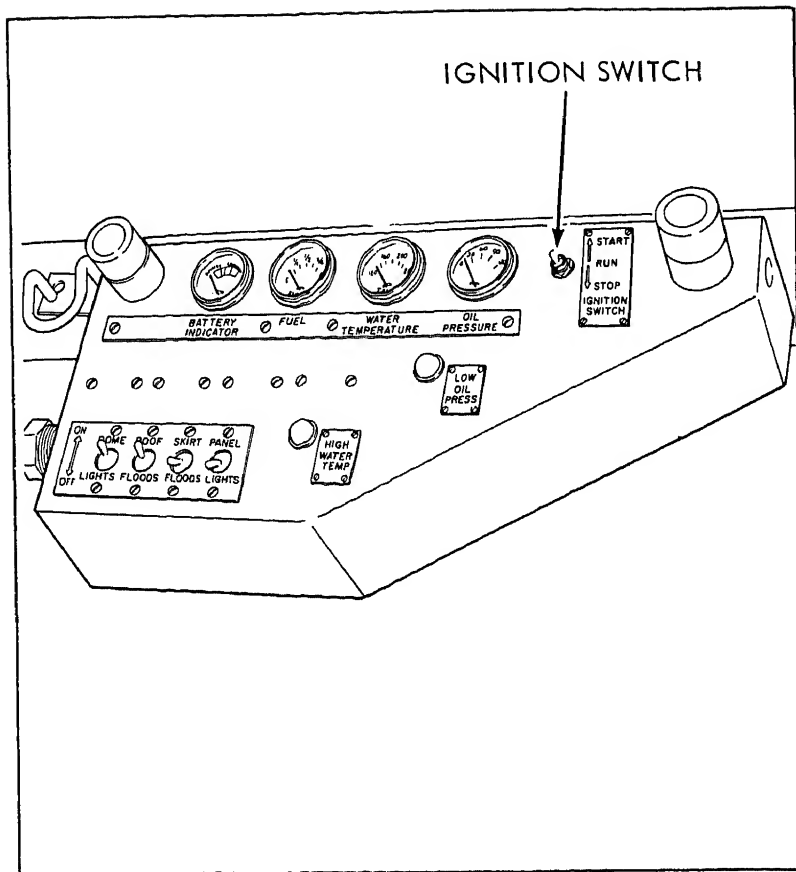
(3) Be sure that the bucket teeth are kept sharp.

(4) Do not use bucket of larger capacity than recommended for normal rapid operation. Overloading results in extra maintenance and delay.

(5) Take an even cut and fill the bucket, being sure to fill the back corners. Keep the drag hitch adjusted for the best penetration of materials.

(6) Piling dirt under the boom foot wastes time and power and makes a wearing trap for the drag cable.

(7) It is important to use the proper length

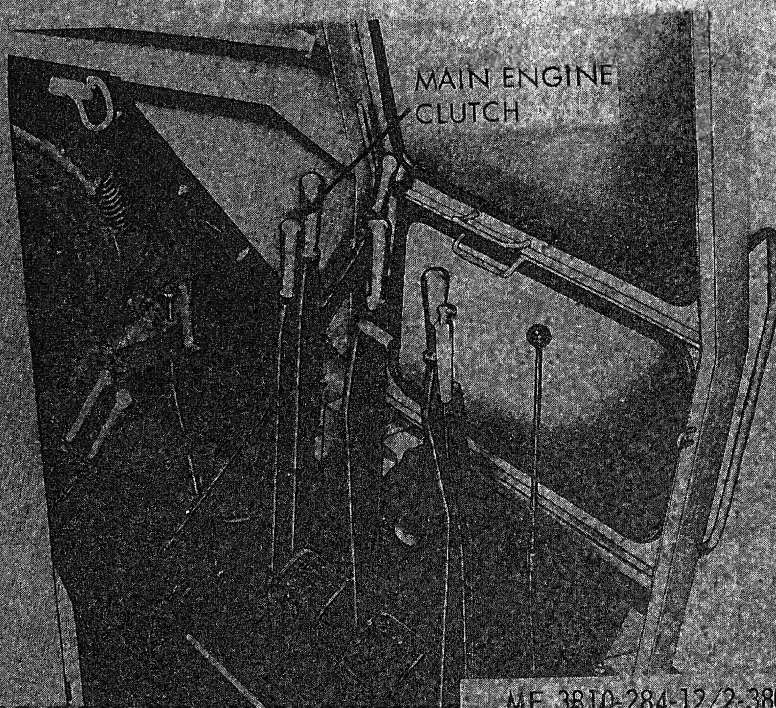
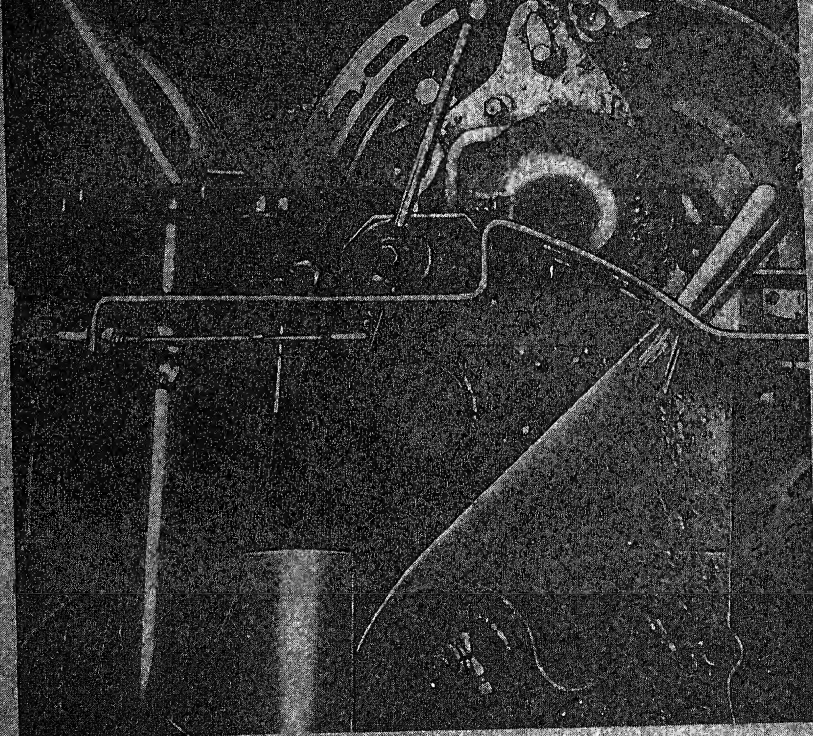


STEP 1. SET THROTTLE FOR IDLE SPEED.

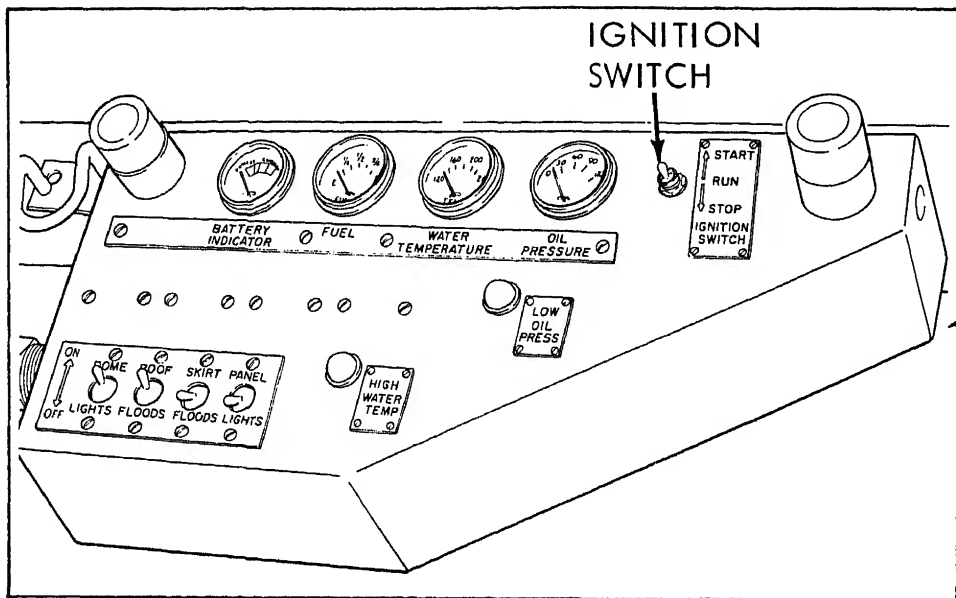
STEP 2. DISENGAGE THE MAIN ENGINE CLUTCH
(PUSH FORWARD).

STEP 3. PUSH THE IGNITION SWITCH UP TO START THE
ENGINE.

CAUTION. TO PREVENT PERMANENT CRANKING MO-
TOR DAMAGE, DO NOT CRANK ENGINE
FOR MORE THAN 30 SECONDS CONTIN-
UOUSLY. IF ENGINE DOES NOT FIRE
WITHIN FIRST 30 SECONDS, WAIT ONE TO



MF 3810-284-12/2-38(2)



NOTE. IT IS IMPORTANT TO IDLE AN ENGINE 3 TO 5 MINUTES BEFORE SHUTTING IT DOWN TO ALLOW LUBRICATING OIL AND WATER TO CARRY HEAT AWAY FROM THE COMBUSTION CHAMBER, BEARINGS, SHAFTS, ETC.

CAUTION. LONG PERIODS OF IDLING ARE NOT GOOD FOR AN ENGINE BECAUSE OPERATING TEMPERATURES DROP SO LOW THE FUEL MAY NOT BURN COMPLETELY. THIS WILL CAUSE CARBON TO CLOG THE INJECTOR SPRAY HOLES AND PISTON RINGS. IF ENGINE COOLANT TEMPERATURE BECOMES TOO LOW, RAW FUEL WILL WASH LUBRICATING OIL OFF CYLINDER WALLS AND DILUTE CRANKCASE OIL SO ALL MOVING PARTS OF THE ENGINE WILL SUFFER FROM POOR LUBRICATION.

STEP 1. THE ENGINE CAN BE SHUT DOWN COMPLETELY

BOOM HOIST
SAFETY PAWL

BOOM HOIST
LEVER

TO GET THE LOAD REQUIRES ACCURATE CONTROL OF THE BOOM AND SWING MOVEMENTS, TO POSITION THE LOAD AT THE EXACT SPOT WITHOUT SHOOTING OR OVERSHOOTING.

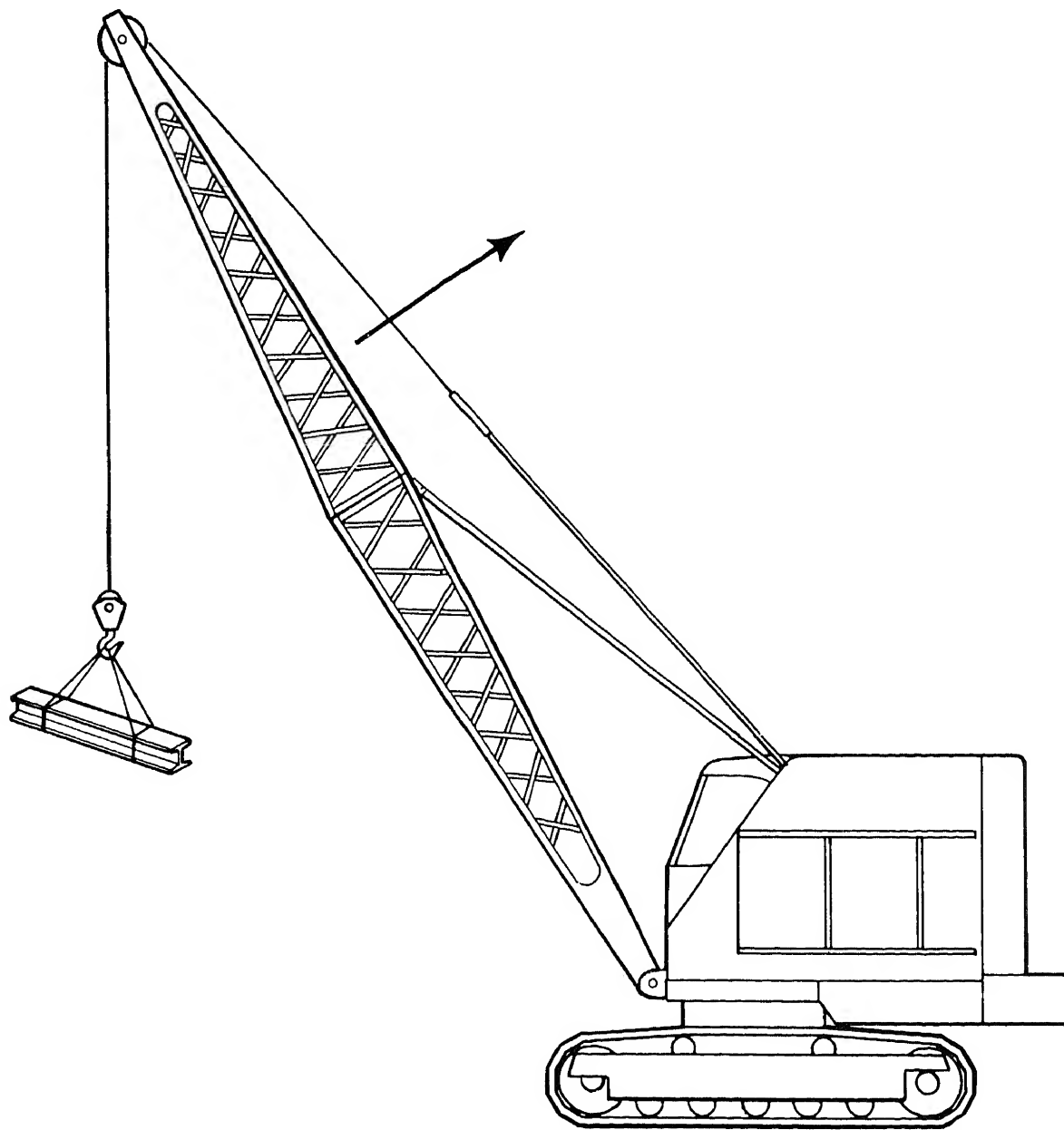
TO RAISE THE BOOM, PULL THE BOOM HOIST LEVER BACK ON THE BOOM HOIST PAWL. TO RELIEVE THE LOAD ON THE BOOM HOIST PAWL, RELEASE PAWL BY PULLING UP THE BOOM HOIST SAFETY PAWL LEVER.

TO LOWER THE BOOM, PULL FORWARD THE BOOM HOIST LEVER. THIS RELEASES THE SPRING-SET BRAKE AND PERMITS THE BOOM TO LOWER AT A RATE DEPENDENT ON THE SPEED OF THE ENGINE.

TO RETURN THE BOOM TO NEUTRAL, IF THE BOOM HOIST LEVER IS PULLED FORWARD, PULL BACK ON THE BOOM HOIST LEVER (IT IS NOT NECESSARY TO RELEASE THE BOOM HOIST SAFETY PAWL). WHEN THE BOOM HAS REACHED THE DESIRED POSITION, RETURN THE BOOM HOIST LEVER TO NEUTRAL.

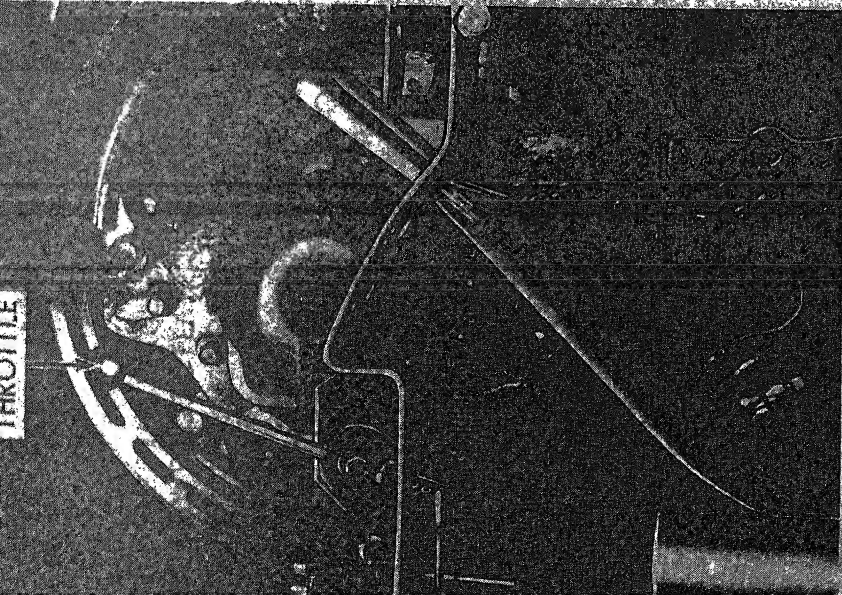
HAS A TENDENCY TO CONTINUE LOWERING AFTER THE BOOM HOIST LEVER HAS BEEN PLACED IN NEUTRAL, PULL THE BOOM HOIST LEVER BACK TO NEUTRAL. THIS SETS THE CLUTCH FOR RAISING THE BOOM AND QUICKLY STOPS THE BOOM. AS SOON AS THE BOOM HAS STOPPED LOWERING, ENGAGE THE BOOM-HOIST SAFETY PAWL BY PUSHING DOWN ON THE BOOM-HOIST SAFETY PAWL LEVER.

STEP 4. TO RAISE THE BOOM, PULL BACK ON THE BOOM-HOIST LEVER (IT IS NOT NECESSARY TO RELEASE THE BOOM-HOIST SAFETY PAWL). WHEN THE BOOM HAS REACHED THE DESIRED POSITION, RETURN THE BOOM-HOIST LEVER TO NEUTRAL.



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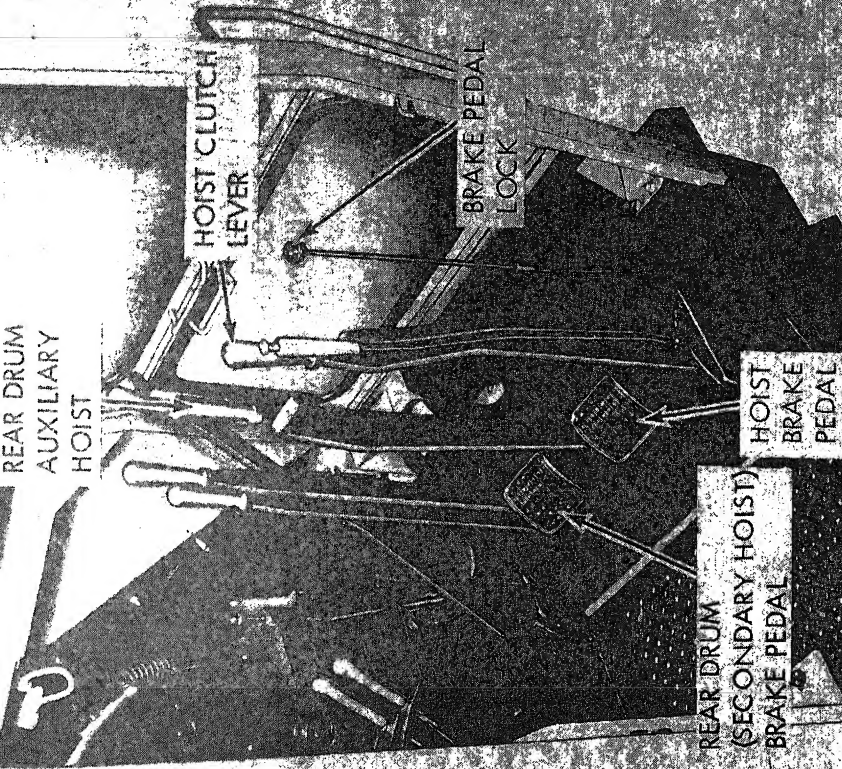
Figure 2-40. Operating the crane-shovel, spotting operation (sheet 2 of 2).



ST THE LOAD, POSITION THE CRANE AT THE PROPER ANGLE FOR THE LOAD WORKING CONDITIONS (FIGURE 2-11). THE CORRECT ANGLE FROM THE LOAD DATA PLATE (FIGURE 1-3).

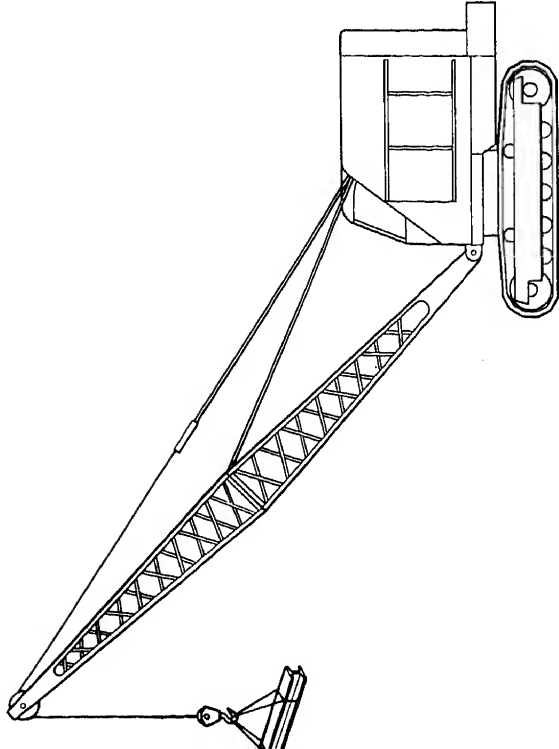
THE CRANE HOOK TO THE LOAD. THE HOIST BRAKE PEDAL WHILE PUSH- FORWARD ON THE HOIST CLUTCH LEVER. ENGAGE THE CLUTCH AND TAKE UP ON THE

REAR DRUM
AUXILIARY
HOIST



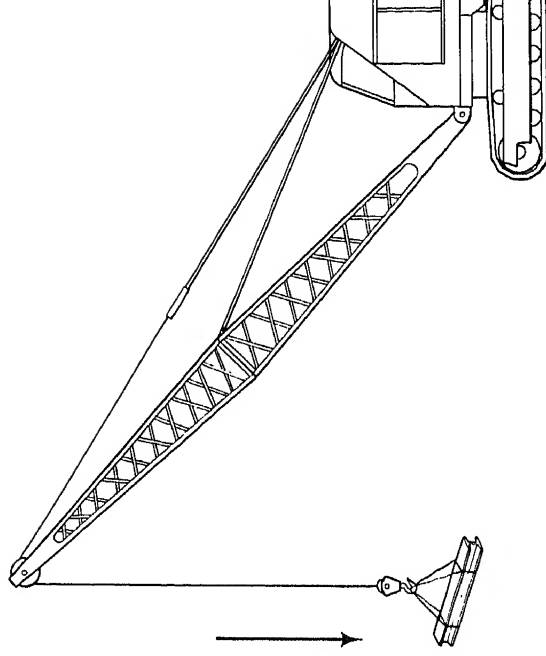
HOIST CABLE. HOIST THE LOAD TO THE DESIRED HEIGHT. APPLY THE HOIST BRAKE PEDAL AND DISENGAGE THE HOIST CLUTCH LEVER BY PULL- ING IT INTO NEUTRAL POSITION. APPLY THE BRAKE BEFORE DISENGAGING THE CLUTCH TO PREVENT THE LOAD FROM FALLING FREE.

STEP 4. LOCK THE BRAKE PEDAL BY PULLING UP ON THE BRAKE PEDAL LOCK. TO LOWER THE LOAD



RAISING THE LOAD

1. TO LOWER THE LOAD UNDER CONTROL OF THE ENGINE, PULL THE HOIST CLUTCH LEVER BACKWARD WHILE RELEASING THE HOIST BRAKE PEDAL. THE SPEED AT WHICH THE LOAD DESCENDS CAN BE CONTROLLED BY THE ENGINE THROTTLE CONTROL.
2. TO LOWER THE LOAD BY GRAVITY, LEAVE THE HOIST CLUTCH LEVER IN NEUTRAL AND CONTROL THE RATE OF DESCENT WITH THE HOIST BRAKE PEDAL ONLY.
3. TO LOCK THE BRAKE IN POSITION, PULL UP ON THE BRAKE PEDAL LOCK LEVER, THEN DEPRESS THE PEDAL UNTIL THE LATCH ENGAGES. TO

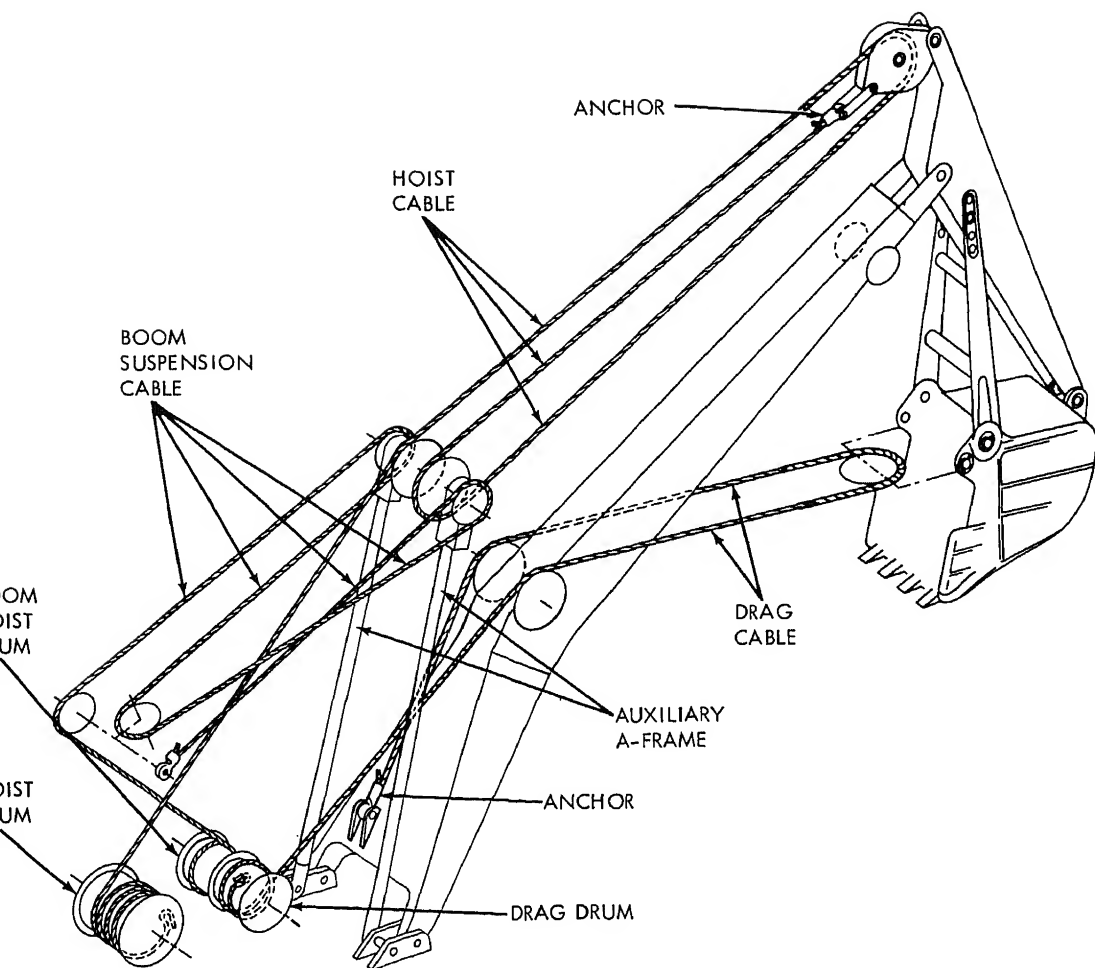


B. LOWERING THE LOAD

RELEASE THE BRAKE, PUSH DOWN THE PEDAL LOCK LEVER THEN DEPRESS THE ONLY THE PEDAL PUSHED DOWN WILL ENGAGE THE LOCK.

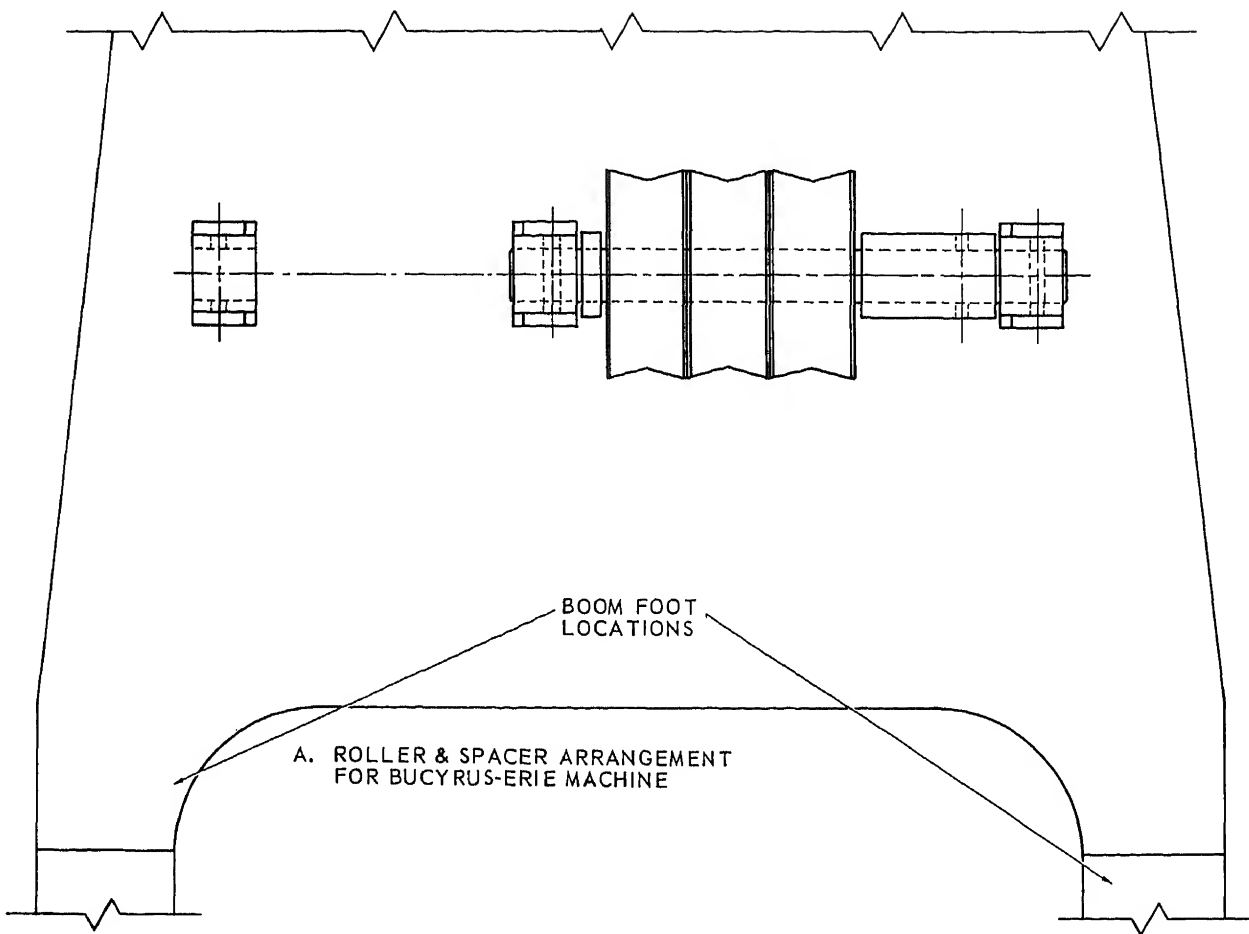
STEP 4. THE AUXILIARY HOIST LINE REEVED TO REAR DRUM IS CONTROLLED BY THE REAR BRAKE PEDAL AND THE REAR DRUM AUXILIARY HOIST.

WARNING. NEVER LEAVE THE MACHINE WITH SUSPENDED ON THE LOCKED FOOT. THE COOLING OF THE BRAKE HOIST TENDS TO RELEASE THE BRAKE AND DROP THE LOAD. ME 3810-289-1



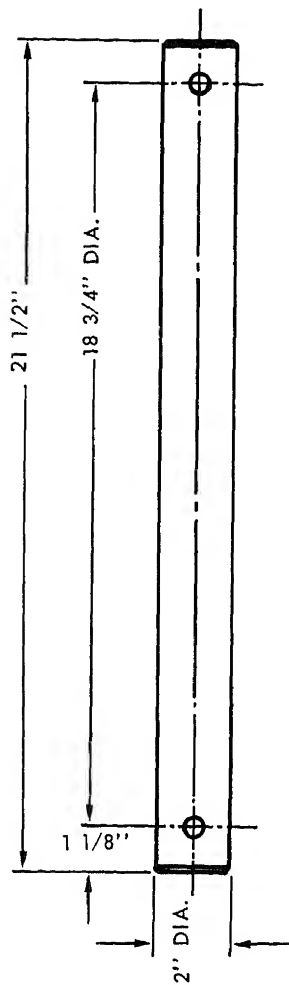
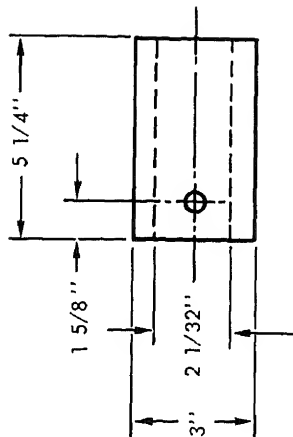
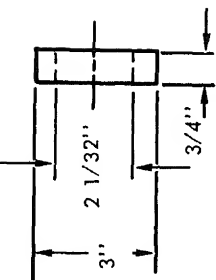
ME 3810-289-12/2-16

Figure 2-16. Backhoe cable reeving.



ME 3810-289-12/ 2-17

Figure 2-17. Roller and spacer arrangement.



ME 3810-289-12/2-18

Figure 2-18. Roller assembly, shaft and spacers.

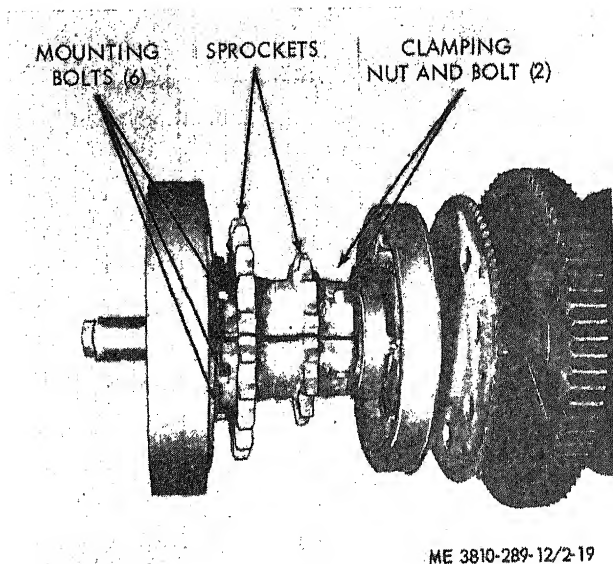


Figure 2-19. Crowd chain sprocket, removal and installation.

(a) Refer to table 4-3 for correct cable length.

(b) Lead cable (1) over left A-frame sheave and attach to boom hoist drum.

(c) Lead cable under left boom point sheave.

(d) Lead cable (2) around upper A-frame yoke sheave and over right boom point sheave.

(e) Lead cable (4) over right A-frame sheave and under right boom point sheave.

(f) Lead cable (6) around lower A-frame yoke sheave and over left boom point sheave.

(g) Attach cable (8) to anchor on A-frame.

(11) Boom raised to 45° angle. Refer to figure 2-23.

(12) Shovel cable reeving.

(a) Hoist (fig. 2-23).

1. Refer to table 4-3 for correct cable

(b) Crowd (fig. 2-23).

1. Refer to table 4-3 for length.

2. Remove cable guard on handle.

3. Loop middle of cable casting.

4. Lead right end of cable around shipper shaft drum, through bottom of boom to the right groove, and socket at right side of crowd drum.

5. Lead left end of cable around shipper shaft drum, through bottom of boom to the left groove, and anchor at left side of crowd drum.

6. Install cable guard and pull all the way out until stops rest against block.

(c) Backhaul (fig. 2-23)

1. Refer to table 4-3 for length.

2. Insert cable in drum socket.

3. Wind one wrap on center drum and attach.

4. Lead other end over top groove on shipper shaft drum and attach to justing bolt on dipper handle.

5. Turn nuts on adjustment bolts down as possible.

(d) Dipper trip (fig. 2-24).

1. Lead end over sheave at top of boom and through guide sheave located 1 foot on right side.

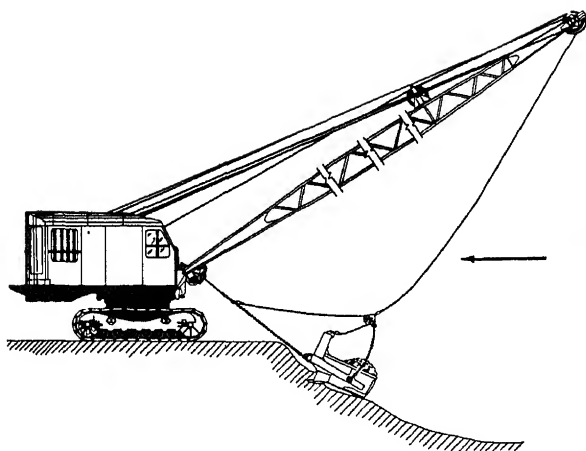
2. Lead cable under deck, over sheave, and attach to dipper trip cable.

3. Attach other end to cable at top of dipper.

(13) Adjustments.

(a) Dipper trip clutch (fig. 2-25).

1. Dipper trip cable should

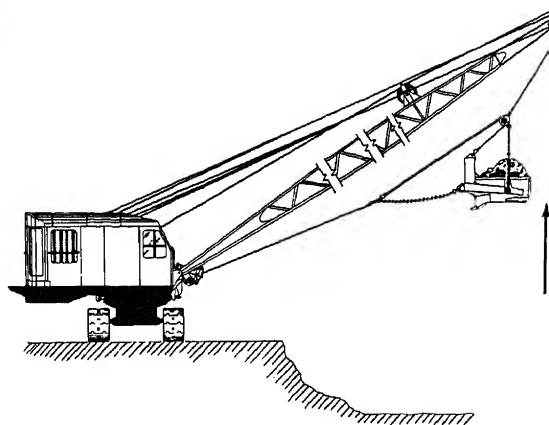


A. DRAGING THE BUCKET

STEP 1. LOWER BUCKET TO DIGGING AREA. IF CUT IS BELOW MACHINE LEVEL, IT WILL BE NECESSARY TO PAY OUT DRAG CABLE TO OBTAIN MAXIMUM BOOM REACH.

STEP 2. RELEASE THE DRAG BRAKE, ENGAGE DRAG CLUTCH, AND EASE OFF THE HOIST BRAKE TO ALLOW HOIST CABLE TO FOLLOW BUCKET.

NOTE: DO NOT PULL THE DRAG CABLE ANCHOR INTO THE FAIRLEAD.



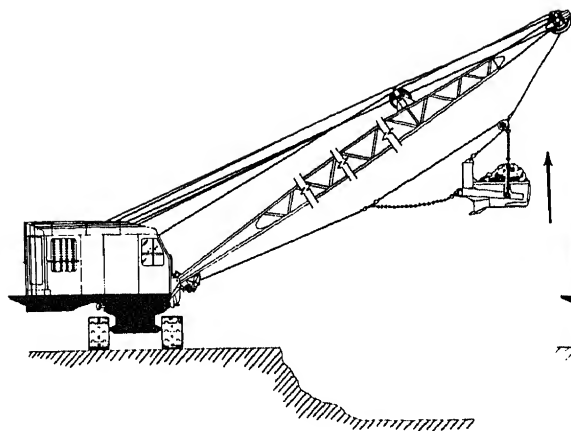
B. HOISTING THE BUCKET

STEP 3. AS SOON AS THE BUCKET IS FILLED, DISENGAGE DRAG CLUTCH, RELEASE HOIST BRAKE AND ENGAGE HOIST CLUTCH. AS THE BUCKET RISES, EASE OFF THE DRAG BRAKE SO THAT DRAG CABLE WILL FOLLOW THE BUCKET.

STEP 4. HOIST BUCKET UNTIL IT IS CLEAR OF OBSTRUCTIONS. DISENGAGE HOIST CLUTCH AND ENGAGE HOIST AND DRAG BRAKES.

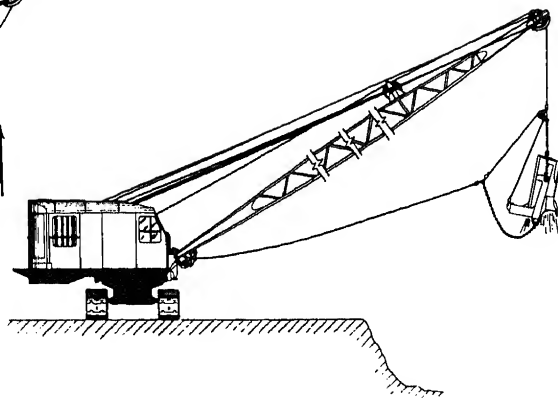
ME 3810-289-12/2-4

Figure 2-45. Operating the dragline (sheet 1 of 2).



C. SWINGING THE MACHINE

STEP 5. SWING THE MACHINE (FIGURE 2-42) TO THE DUMPING AREA.



D. DUMPING THE BUCKET

STEP 6. DUMP THE BUCKET BY RELEASING THE DRAG BRAKE. WHEN THE LOAD IS DUMPED RETURN TO DIGGING AREA.

ME 3810-289-12/2-45 (2)

Figure 2-45. Operating the dragline (sheet 2 of 2).

9. Operation of Clamshell

General.

(1) Keep the boom as high as conditions will permit, but be careful not to let the bucket swing past the underside of the boom.

(2) Keep sufficient tension on the bucket line so that the bucket will not spin and foul cables.

(3) When transferring material from a pile, always excavate the center of it so that material falls inwards, and helps to insure full bucket every time.

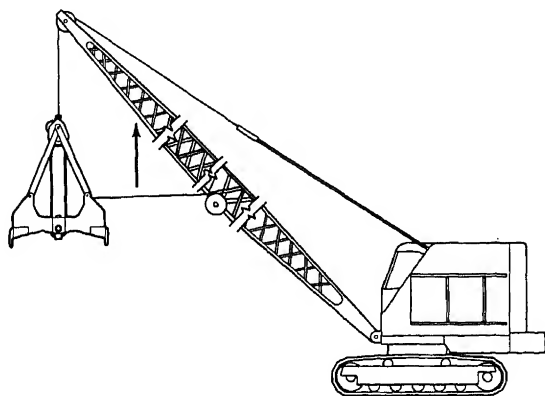
(4) Start and stop the swing motion slowly so that the loaded bucket will not swing excessively.

(5) Do not disengage the main clutch or leave the cab when the bucket is off the ground.

Operation.

(1) Start the crane-shovel (para 2-15).

(2) Refer to figure 2-46 to operate the clam-



A. RAISING OPEN BUCKET

STEP 1. HOIST OPEN BUCKET BY RELEASING HOLD AND HOIST BRAKES AND PUSHING HOLD-LOWER CLUTCH LEVER FORWARD. HOIST UNTIL

2-20. Operation of Backhoe

a. General.

(1) Be sure that the dipper teeth are kept sharp and built up to proper size.

(2) When dragging in the dipper, keep a slight pressure on the hoist brake; this will insure that the weight of the boom is not transferred to the dipper.

(3) Don't swing into trench walls. Be sure to clear bank or trench wall when hoisting out of the cut before attempting to swing.

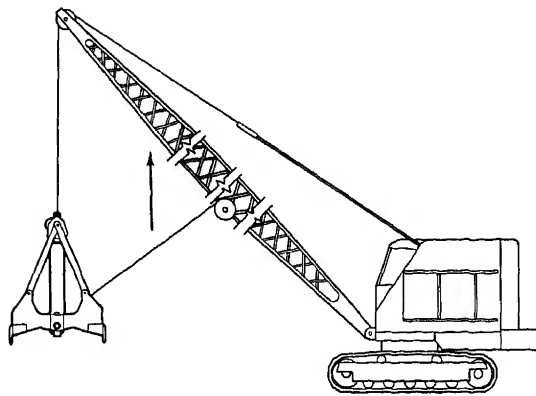
(4) Do not allow the machine to stand at the end of the trench or near the edge of other excavation during the shutdown hours.

(5) Do not propel the machine back over a partly excavated trench.

b. Operation.

(1) Start the crane-shovel (para 2-15).

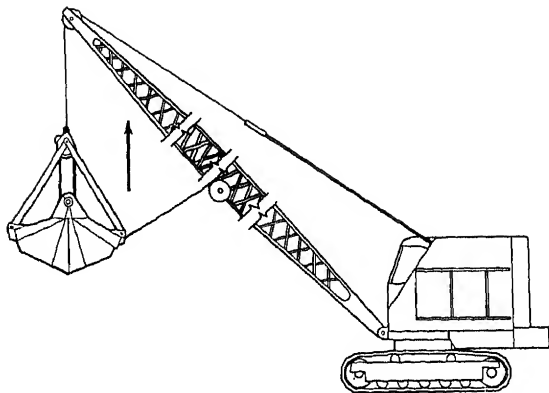
(2) Refer to figure 2-47 to operate the backhoe.



B. LOWERING OPEN BUCKET

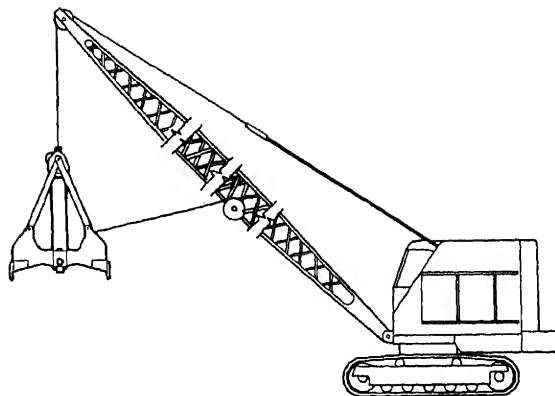
STEP 3. SWING MACHINE (FIGURE 2-42) TO DIGGING AREA.

STEP 4. LOWER OPEN BUCKET BY RELEASING HOLD



C. RAISING CLOSED BUCKET

STEP 5. FILL, CLOSE, AND HOIST BUCKET BY PUSHING HOIST-CLOSE CLUTCH LEVER FORWARD AND PUSHING HOLD-LOWER CLUTCH LEVER FORWARD JUST ENOUGH TO PLACE SLIGHT DRAG ON REAR DRUM CLUTCH. DRAG WILL CAUSE REAR DRUM TO WIND HOLDING CABLE WHILE BUCKET IS BEING CLOSED AND HOISTED BY THE CLOSING CABLE.



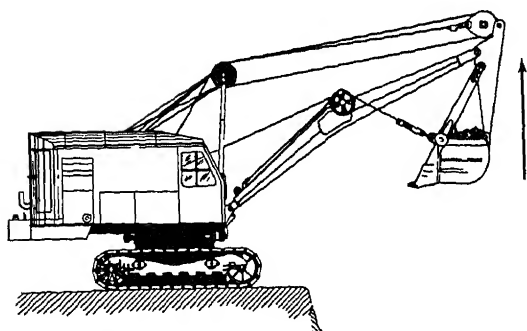
D. DUMPING BUCKET

STEP 6. SWING MACHINE (FIGURE 2-42) TO DUMP AREA.

STEP 7. DUMP BY RELEASING HOIST BRAKE.

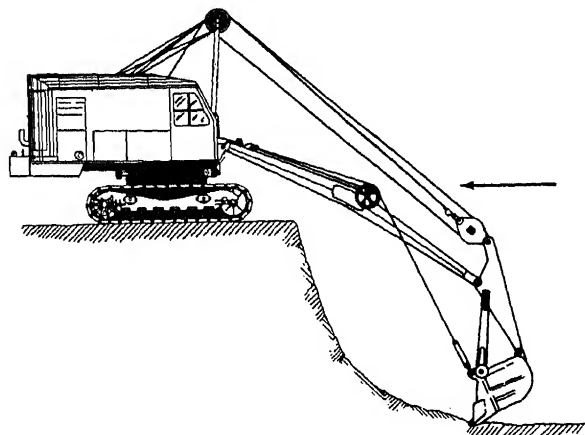
ME 3810-289-12/2-46 (2)

Figure 2-46. Operating the clamshell (sheet 2 of 2).



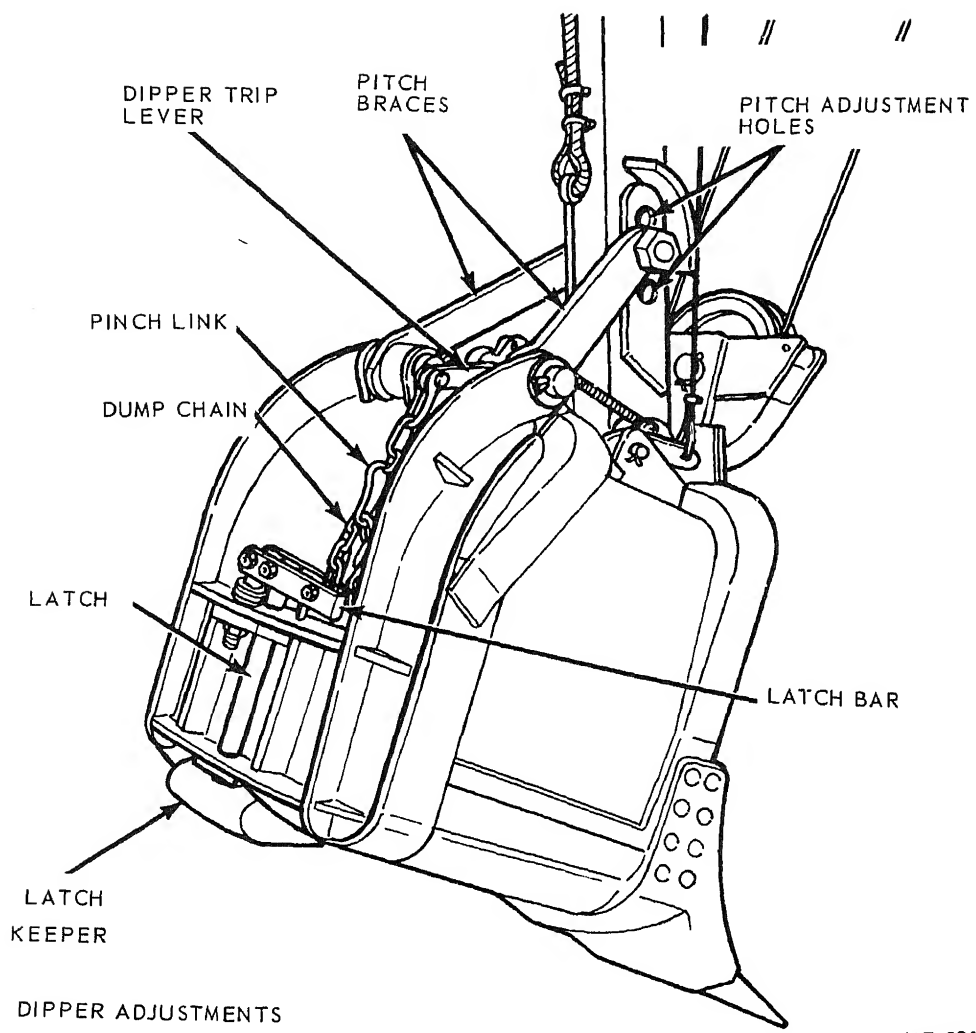
A. HOISTING THE DIPPER

STEP 1. HOIST AND EXTEND DIPPER BY PUSHING HOIST CLUTCH LEVER FORWARD AND RIDING DRAG



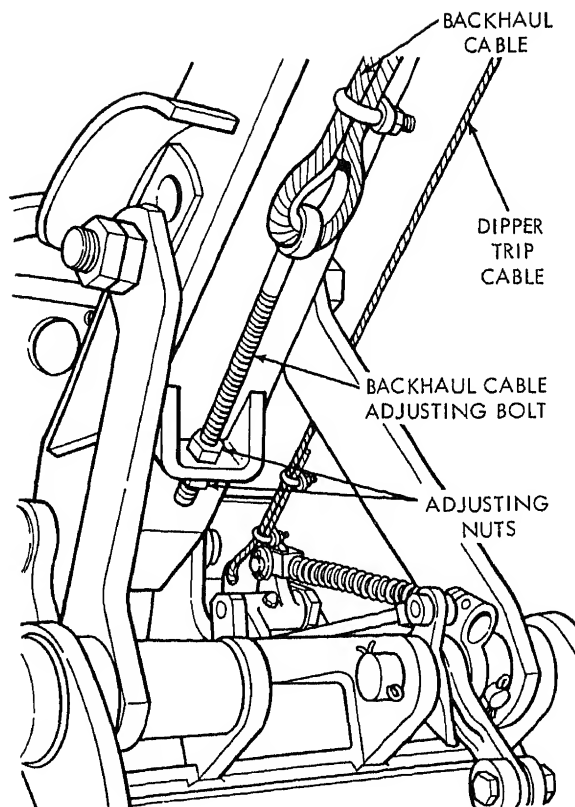
B. DRAGGING THE DIPPER

STEP 4. DRAG DIPPER BY PUSHING DRAG CLUTCH LEVER FORWARD AND EASING OFF THE HOIST BRAKE.



ME 3810-289-12

Figure 2-26. Dipper adjustment.



ME 3810-289-12/2-27

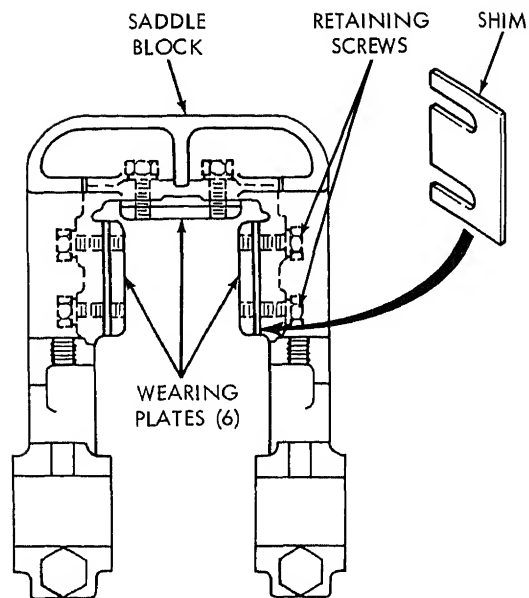
Figure 2-27. Backhaul cable adjustment.

c. Disassembly.

(1) To disassemble catwalk, reverse procedure in *b*, above.

(2) To disassemble lead sections, lower boom so lead assembly rests on ground. Back up machine and lower boom simultaneously, coordinating the two movements until lead assembly rests on blocks or ground.

d. List of Common Hardware (fig. 2-29).



ME 3810-289-12/2-28

Figure 2-28. Saddle block wearing plate adjustment.

(1) Lead assembly top section (each)

Twelve hexagon bolts, $\frac{3}{4}$ in. x 2 in. long

Twelve lockwashers

Twelve hexagon nuts, $\frac{3}{4}$ in.

Four hexagon bolts, $\frac{7}{8}$ in. x 3 in. long

Four lockwashers

Four hexagon nuts, $\frac{3}{4}$ in.

(2) Lead assembly lower section (each)

Sixteen hexagon bolts, $\frac{3}{4}$ in. x 2 in. long

Sixteen lockwashers

Sixteen hexagon nuts, $\frac{3}{4}$ in.

Four hexagon bolts, $\frac{7}{8}$ in. x 3 in. long

Four lockwashers

Four hexagon nuts, $\frac{3}{4}$ in.

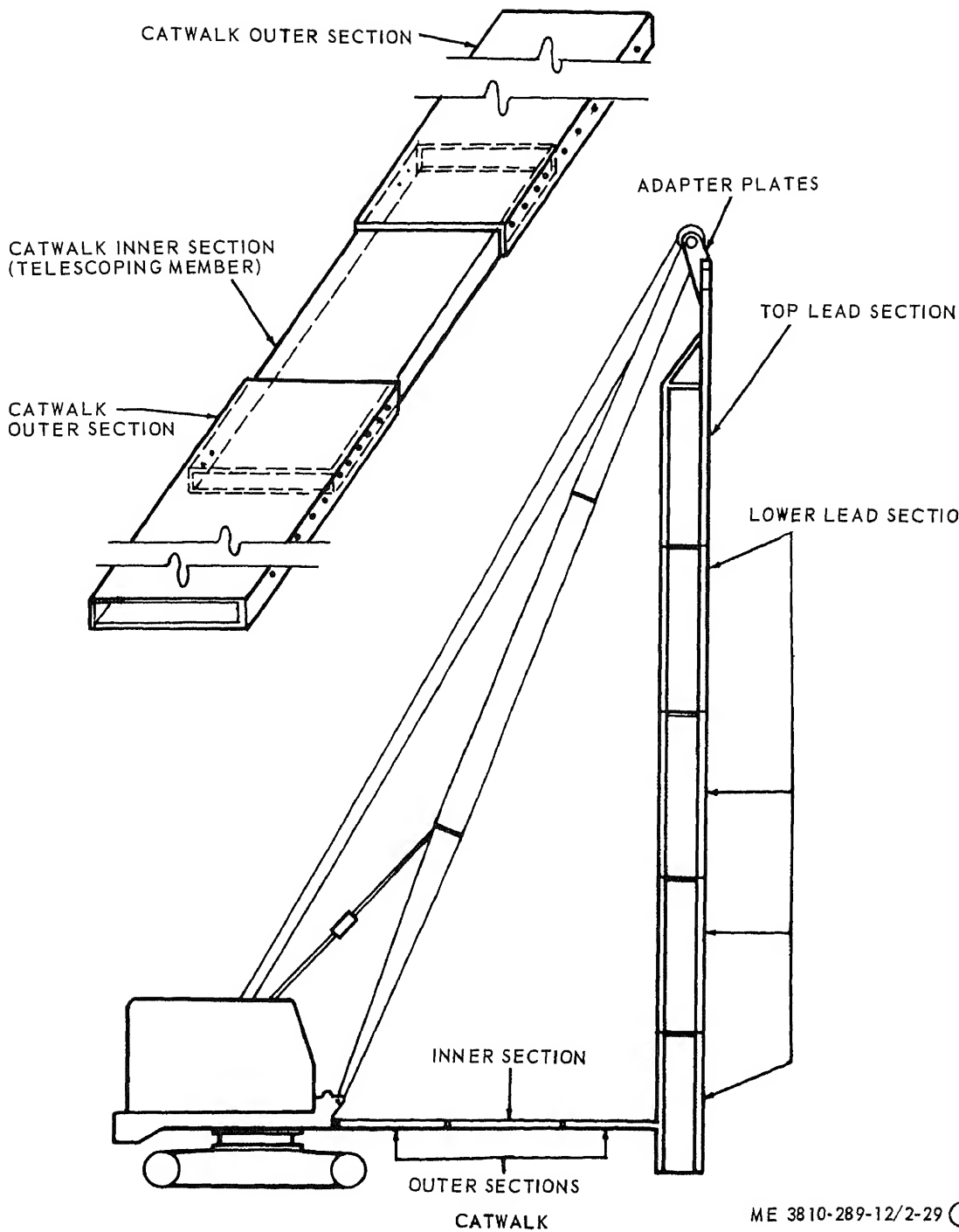
(3) Catwalk assembly.

Two square bolts, $\frac{1}{2}$ in. x $2\frac{5}{8}$ in. long

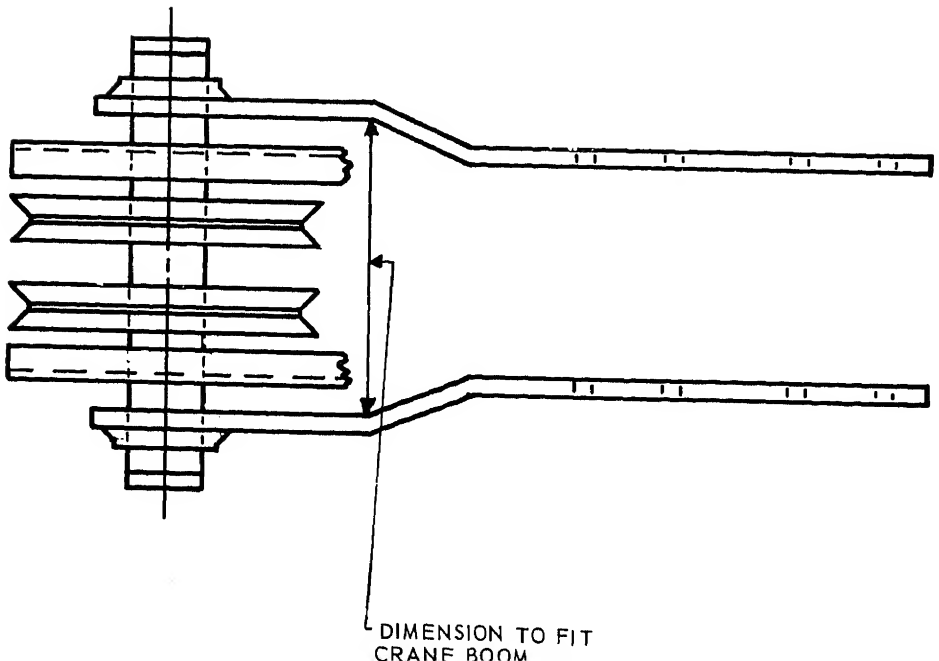
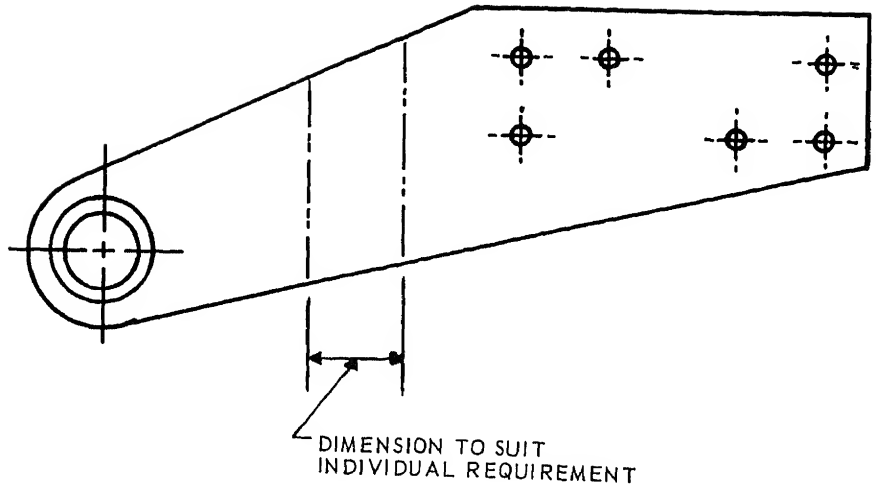
Eight hexagon bolts, $\frac{1}{2}$ in. x 2 in. long

Ten lockwashers

Ten hexagon nuts, $\frac{1}{2}$ in.



PILE DRIVER LEAD ADAPTER



d. The crane-shovel has sufficient bearing area for propelling over average soft ground. Where ground is too soft to support the machine, timber mats should be used. These can be made by drilling holes through logs or timber and inserting rod bolts or wire rope to hold them together. Use of rope gives completed mat more flexibility to follow uneven ground conditions than use of rod bolts. Addition of timbers or planks along sides of mat will help prevent machine slipping sideways off mat. Mats can be made in sections about 6 feet wide by 12 feet long with rope slings at ends. Sections can be hoisted with a separate rope or chain sling and swung from rear to front as machine progresses.

e. If material or time for mat construction is not available, logs or branches can be laid crossways of tracks to form corduroy road for propelling over soft ground.

f. Extra traction for unusually soft or loose footing can be improvised by drilling four holes in every fourth tread and bolting on bars or

short lengths of chain. The use of bolts only in the drilled holes will in some cases provide the extra traction required.

2-26. Operation in Salt-Water Areas

If machine is operated within a few miles of seacoast, paint exposed painted surfaces (outside of cab, boom, etc.) carefully with suitable paint and take care in repainting wherever and whenever paint becomes scratched or worn away. Exposed metal parts that cannot be painted should be kept well coated with oil or grease. If machine operated with lower works immersed in salt water, parts that are in contact with water should be kept well coated with asphaltum.

2-27. Operation in High Altitudes

The crane-shovel is designed to operate at altitudes up to 5,000 feet above sea level. High altitudes will require readjustment of the fuel pump and fuel injectors to maintain the proper air and fuel mixture.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. BASIC ISSUE ITEMS

1. Tools and Equipment

Tools, equipment, and repair parts issued with the crane are authorized for the model 22BM crane-shovel. These items are listed in the basic issue items list, appendix C.

3-2. Maintenance and Operating Supplies

Maintenance and operating supplies required for initial operation are listed in section III, appendix C.

Section II. LUBRICATION INSTRUCTIONS

3. General

This section contains lubrication instructions which are supplemental to, and not specifically covered, in the lubrication order. For the current lubrication order, refer to DA PAM 310-4 (Military Publications).

4. Detailed Lubrication Information

a. General. Keep all lubricants in closed containers and store in a clean, dry place, away from external heat. Allow no dust, dirt, or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready for use.

b. Cleaning. Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication

points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

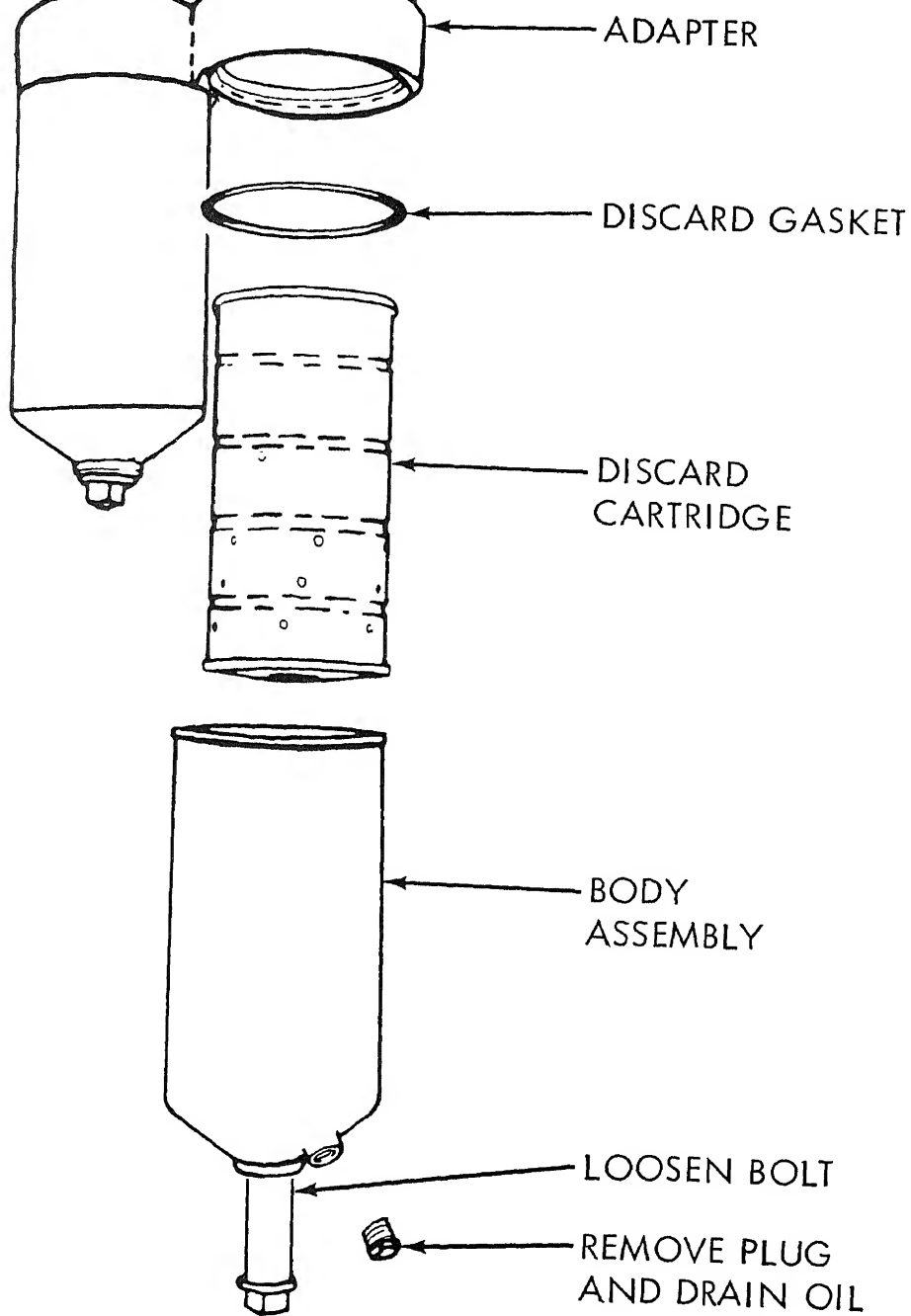
c. Points of Lubrication. Service the lubrication points at proper intervals as illustrated on the lubrication order.

d. OES Oil.

(1) Crankcase oil level must be checked frequently, as oil consumption may increase.

(2) Oil may require changing more frequently than usual because contamination by dirt and sludge formation will increase under cold weather operation conditions.

e. Oil Filter Service. Refer to figure 3-1 and service the oil filter.



NOTE: THE OIL FILTER SHOULD BE CHANGED AFTER 800 GALLONS OF FUEL HAVE BEEN USED, OR AFTER 250 HOURS, WHICHEVER COMES FIRST.

Section III. CONTROLS AND INSTRUMENTS

2-12. General

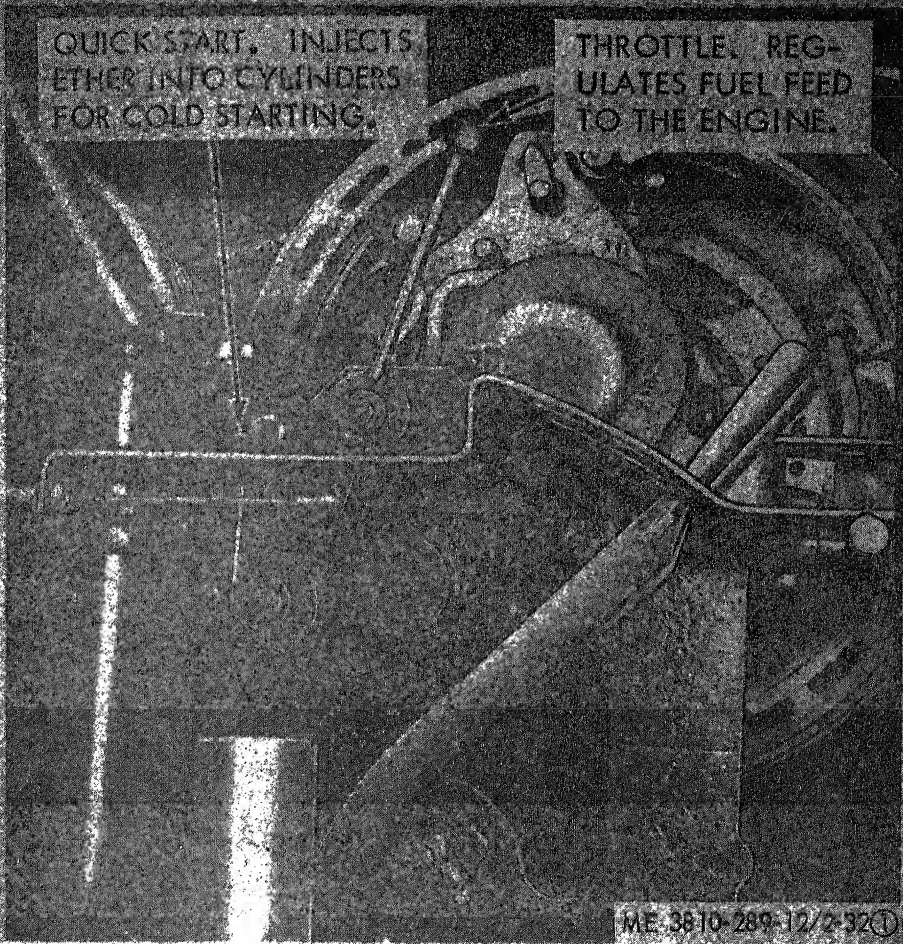
This section describes, locates, illustrates, and furnishes operator, crew, or organizational maintenance personnel sufficient information about various controls and instruments for proper operation of the model 22BM crane-shovel.

2-13. Controls and Instruments

The purpose of controls and instruments and the normal and maximum reading are illustrated in figures 2-32 through 2-37.

QUICK START. INJECTS
ETHER INTO CYLINDERS
FOR COLD STARTING.

THROTTLE. REG-
ULATES FUEL FEED
TO THE ENGINE.



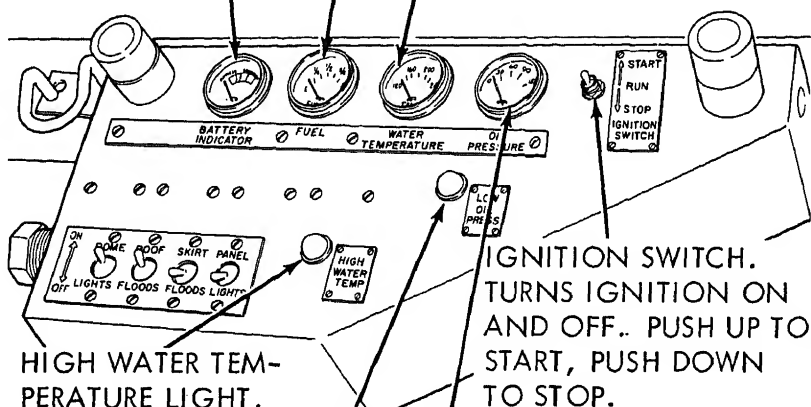
ME 3810-289-12/2-32①

Figure 2-32. Engine controls and instruments (sheet 1 of 2).

BATTERY INDICATOR. INDICATES WHETHER THE BATTERY IS RECEIVING OR DISCHARGING CURRENT. UNDER NORMAL CONDITIONS IT SHOULD INDICATE A SLIGHT CHARGE.

FUEL GAGE. INDICATES AMOUNT OF FUEL IN THE FUEL TANK.

WATER TEMPERATURE GAGE. INDICATES TEMPERATURE OF THE WATER IN THE COOLING SYSTEM.



HIGH WATER TEMPERATURE LIGHT. COMES ON WHEN THE WATER TEMPERATURE GETS ABOVE 210°F.

LOW OIL PRESSURE LIGHT. COMES ON WHEN THE OIL PRESSURE GETS BELOW 10 psi.

OIL PRESSURE GAGE. INDICATES AMOUNT OF OIL PRESSURE IN THE SUPPLY LINES OF THE ENGINE CRANKCASE. NORMAL READING IS AROUND 40 psi.

IGNITION SWITCH. TURNS IGNITION ON AND OFF.. PUSH UP TO START, PUSH DOWN TO STOP.

DRIVE-CHAIN END. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO SWING RIGHT OR TO PROPEL TOWARD DRIVE CHAIN END.

MAIN ENGINE CLUTCH LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO ENGAGE.

SWING LOCK LEVER. PUSH FORWARD TO RELEASE; PULL BACK TO LOCK.

BOOM-HOIST SAFETY PAWL LEVER. PULL UP TO RELEASE; PUSH DOWN TO LOCK.

DIGGING LOCK LEVER. PUSH FORWARD TO LOCK BOTH WAYS. MIDDLE POSITION IS TO LOCK ONE WAY. PULL BACK TO RELEASE BOTH WAYS.

SWING-PROPEL SPLINE CLUTCH LEVER. PUSH FORWARD FOR PROPEL POSITION. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK FOR SWING POSITION.

REAR DRUM (SECONDARY HOIST) BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

HOIST BRAKE PEDAL. PUSH FORWARD TO BRAKE. SPRING RELEASED UNLESS LOCKED.

HOIST TO STEER STRAIGHT AHEAD. PULL BACK TO STEER LEFT (WITH DRIVE CHAINS REAR).

REAR DRUM (SECONDARY HOIST) LEVER. PUSH FORWARD TO HOIST. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO LOWER.

HOIST CLUTCH LEVER. PUSH FORWARD TO HOIST. MIDDLE POSITION IS FOR NEUTRAL. PULL BACK TO LOWER.

BOOM-HOIST LEVER. PUSH FORWARD TO LOWER BOOM (WHEN PAWL IS RELEASED). MIDDLE POSITION HOLDS BOOM. PULL BACK TO RAISE BOOM.

BRAKE PEDAL LOCK LEVER. PULL UP TO ALLOW LOCK. PUSH DOWN TO ALLOW RELEASE OF BRAKE PEDALS.

DIPPER TRIP LEVER. PUSH FORWARD TO TRIP. PULL BACK TO RELEASE (SPRING RELEASED). NOTE: FOR USE WITH SHOVEL FRONT END ONLY.

Malfunction	Probable cause	Corrective action
7. Clamshell operates erratically.	<ol style="list-style-type: none"> Hoist brake grabbing. Clutches grabbing. Lack of lubrication. 	<ol style="list-style-type: none"> Adjust brakeband (para 3-30). Adjust clutch (para 3-29). Lubricate (see LO).
8. Clamshell bucket fails to close.	Closing line jammed in sheaves.	Lower bucket and free line.
9. Clamshell bucket fails to open.	Holding line jammed in sheaves.	Lower bucket and free line.
10. Dragline not operating properly.	<ol style="list-style-type: none"> Dump cable not adjusted properly. Fairlead rollers and sheaves. 	<ol style="list-style-type: none"> Shorten or lengthen dump cable until proper operation is obtained. Lubricate (refer to LO).
11. Shovel bucket fails to open.	<ol style="list-style-type: none"> Dipper trip cable jammed. 	<ol style="list-style-type: none"> Check dipper trip cable reeving (fig. 2-24).
12. Shovel bucket fails to close.	<ol style="list-style-type: none"> Dipper latch bar bent. 	<ol style="list-style-type: none"> Check bar (fig. 2-26).
13. Shovel not operating properly.	<ol style="list-style-type: none"> Door or latch jammed. Dipper trip handle stuck. 	<ol style="list-style-type: none"> Remove foreign material. Operate handle.
14. Backhoe not operating properly.	<ol style="list-style-type: none"> Dipper pitch not correct. Crowd brake not adjusted. 	<ol style="list-style-type: none"> Correct the dipper pitch (fig. 2-26). Adjust crowd brake (fig. 2-21).
	<ol style="list-style-type: none"> Cable out of sheave groove. Brakeband dragging. 	<ol style="list-style-type: none"> Replace cable in sheave groove. Adjust brake (para 3-30).

Section V. MAINTENANCE OF ENGINE CLUTCH ASSEMBLY, RELEASE MECHANISM CONTROL LEVERS, AND TURNABLE SWINGLOCK

3-9. General

Instructions in this section are published for the information and guidance of the operator to maintain the crane-shovel.

3-10. Clutch Assembly

a. General. The main engine clutch (fig. 3-2) should engage smoothly with a distinct snap and reasonably hard lever action. It should be adjusted at the first sign of slippage.

b. Inspection (fig. 3-3). Check to see if operating clutches hold securely when engaged and are completely free when operating levers are in neutral position. Check operating linkage for wear and proper operation, and see that connecting pins and bolts are secure.

c. Service. The engine clutch pilot bearing may be sealed-type or may be greased sparingly every

3-11. Control Levers Adjustment

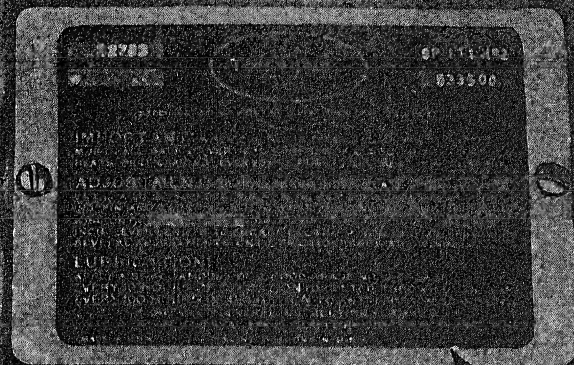
Adjust linkage by tightening or loosening adjusting nuts on rod ends or adjustable devices until control levers are in a vertical position when in neutral and aligned with each other in the main lever bank (fig. 3-4).

3-12. Swing Lock Adjustment (fig. 3-5)

a. Pull the swing lock lever back and check the engagement of the lock between the teeth of the fixed gear ring. The lock should extend at least half way along the teeth profile; if it does not, put the control lever in the forward position, remove pins "A" and "B" and unscrew the adjusting screw one or two turns.

b. Reassemble the pins in the toggle links and check that the lock does not foul the top of the teeth.

BOLT
(12)

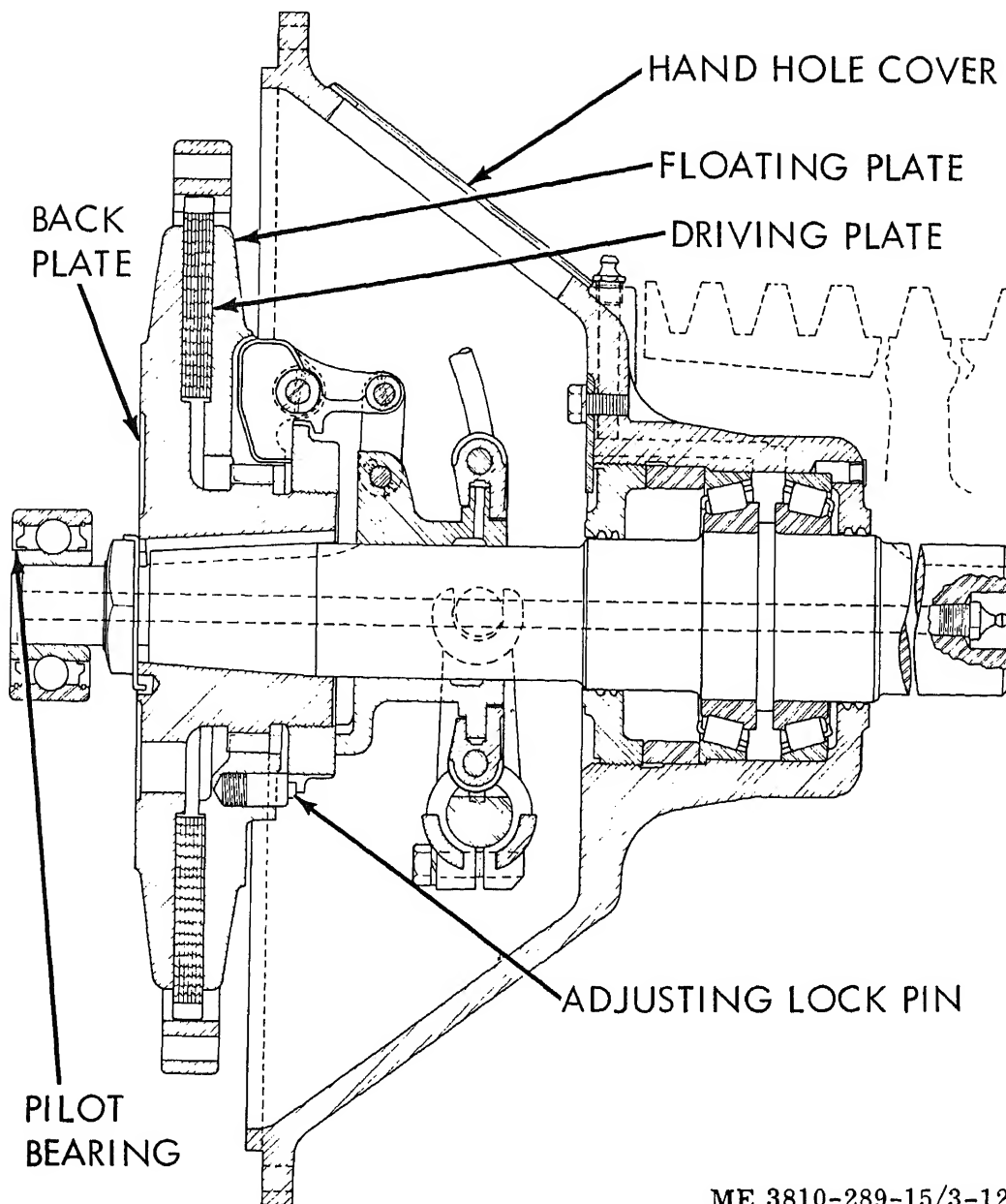


CLUTCH
HOUSING

HYDRAULIC
FITTING

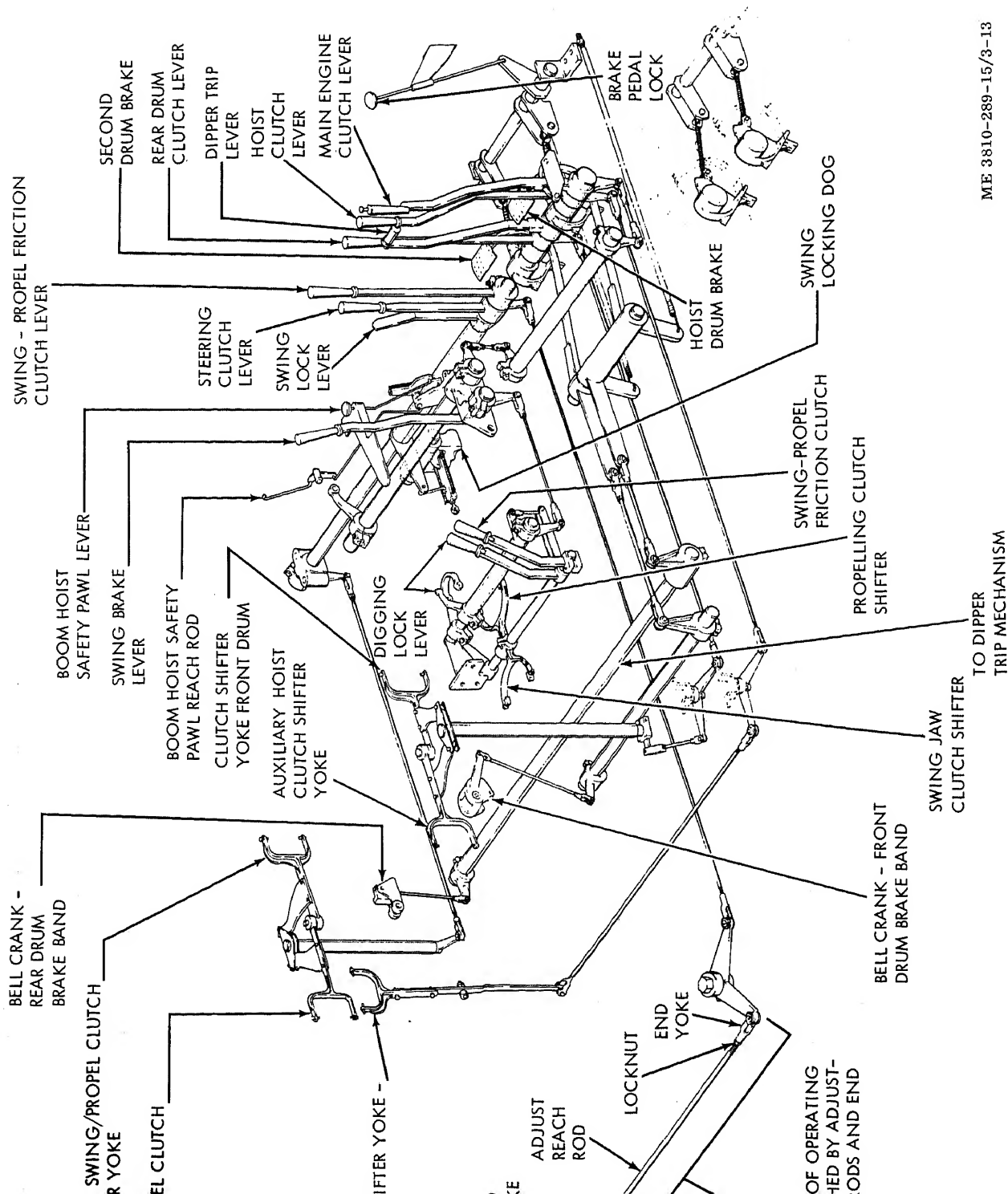
INSTRUCTION
PLATE

TRANSMISSION
CHAIN



ME 3810-289-15/3-12

Figure 3-3. Engine clutch assembly inspection.



Section IV. OPERATION UNDER USUAL CONDITIONS

-14. General

a. Instructions in this section are published for information and guidance of personnel responsible for operation of the crane-shovel.

b. The operator must know how to perform every operation of which the crane-shovel is capable. This section gives instructions on starting and stopping the crane-shovel, basic motions of the crane-shovel, and on coordinating basic motions to perform specific tasks for which the equipment is designed. Since nearly every job presents a different problem, the operator may have to vary given procedures to fit the individual job.

-15. Starting

a. *Preparation for Starting.*

(1) Perform necessary daily preventive maintenance services (para 3-6).

(2) Check load requirements.

b. *Starting.* Refer to figure 2-38 and start the crane-shovel.

-16. Stopping

a. Refer to figure 2-39 and stop the crane-shovel.

b. Perform the necessary daily preventive maintenance operations (para 3-6).

-17. Operation of Crane

a. *General.*

(1) Be sure the boom length and boom angle are such that the load to be lifted comes within the limit given in the table of maximum allowable lifting loads (para 1-5b, (9)).

(2) Crane ratings are based on a firm and level foundation for the crane and if the footing is soft enough so that the crane will sink in to any

(5) If necessary to propel with the load suspended, snub it to the foot of the boom to prevent it swinging out beyond the boom point.

(6) Keep the load as low as possible and use extreme care when traveling with a high boom.

(7) Use the auxiliary hoist line for light loads only.

(8) Be sure hoist and boom suspension cables are in good condition before making a heavy lift.

(9) Use the boom hoist to change the boom angle for accurately spotting the load, but avoid using the boom hoist with heavy loads suspended.

b. *Operation.*

(1) Start the crane-shovel (para 2-15).

(2) Refer to figures 2-40 through 2-44 to operate the crane.

2-18. Operation of Dragline

a. *General.*

(1) Work with boom at highest angle that will allow the reach and accuracy needed for the particular job.

(2) Avoid pulling the drag cable socket in the fairlead.

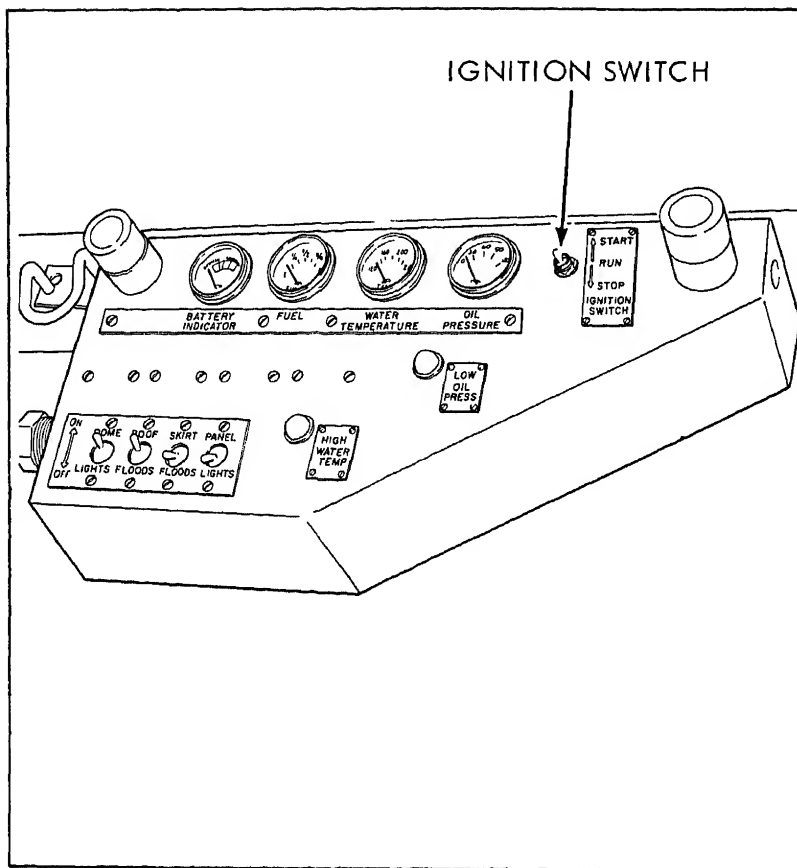
(3) Be sure that the bucket teeth are kept sharp.

(4) Do not use bucket of larger capacity than recommended for normal rapid operation. Overloading results in extra maintenance and delay.

(5) Take an even cut and fill the bucket, being sure to fill the back corners. Keep the drag hitch adjusted for the best penetration of materials.

(6) Piling dirt under the boom foot wastes time and power and makes a wearing trap for the drag cable.

(7) It is important to use the proper length

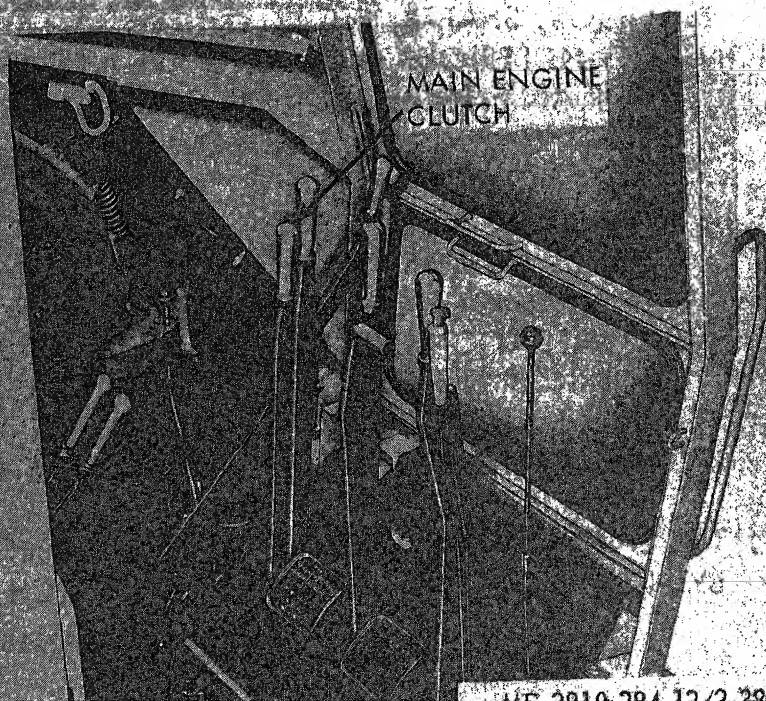
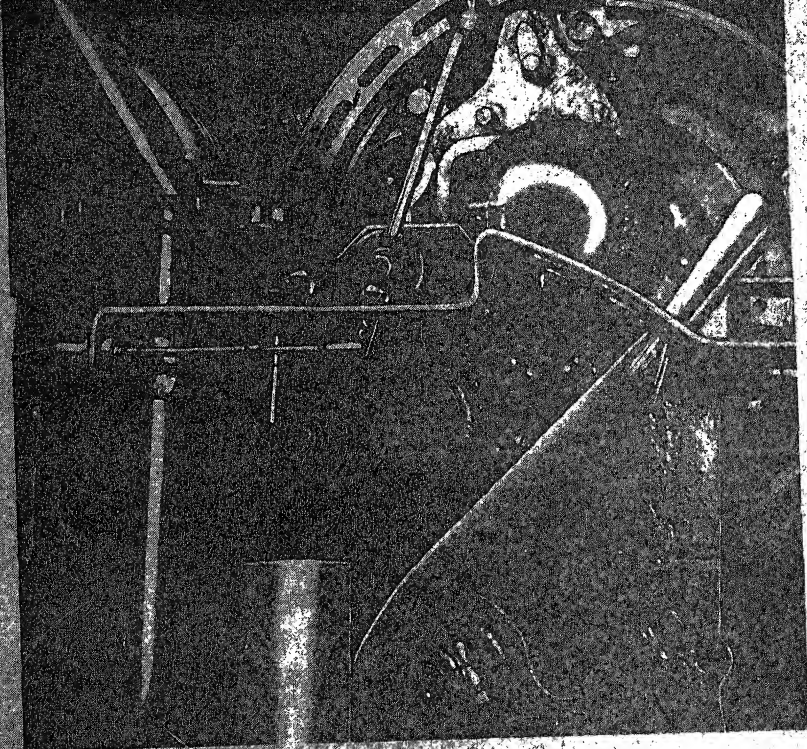


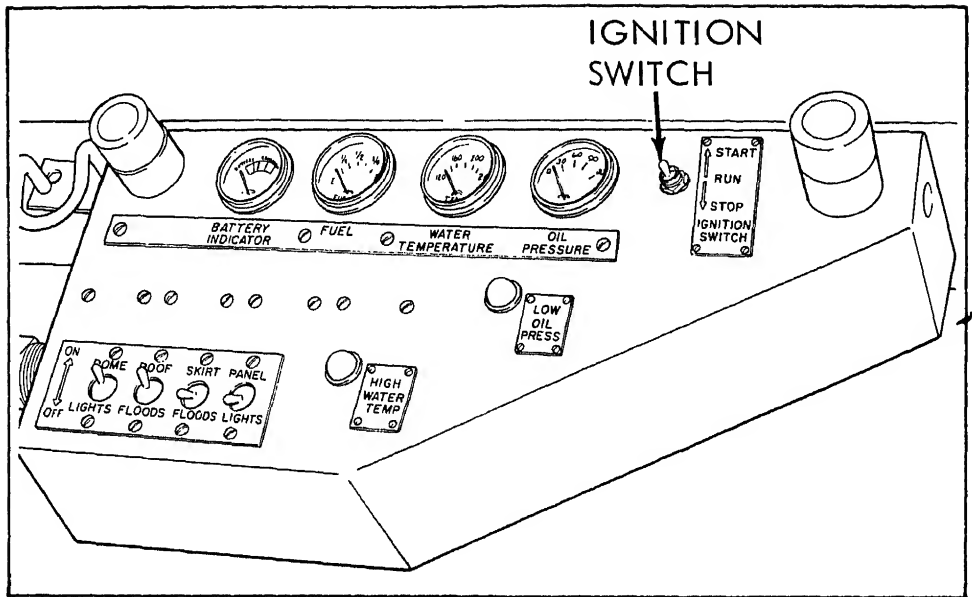
STEP 1. SET THROTTLE FOR IDLE SPEED.

STEP 2. DISENGAGE THE MAIN ENGINE CLUTCH
(PUSH FORWARD).

STEP 3. PUSH THE IGNITION SWITCH UP TO START THE
ENGINE.

CAUTION. TO PREVENT PERMANENT CRANKING MO-
TOR DAMAGE, DO NOT CRANK ENGINE
FOR MORE THAN 30 SECONDS CONTINU-
OUSLY. IF ENGINE DOES NOT FIRE
WITHIN FIRST 30 SECONDS, WAIT ONE TO





NOTE. IT IS IMPORTANT TO IDLE AN ENGINE 3 TO 5 MINUTES BEFORE SHUTTING IT DOWN TO ALLOW LUBRICATING OIL AND WATER TO CARRY HEAT AWAY FROM THE COMBUSTION CHAMBER, BEARINGS, SHAFTS, ETC.

CAUTION. LONG PERIODS OF IDLING ARE NOT GOOD FOR AN ENGINE BECAUSE OPERATING TEMPERATURES DROP SO LOW THE FUEL MAY NOT BURN COMPLETELY. THIS WILL CAUSE CARBON TO CLOG THE INJECTOR SPRAY HOLES AND PISTON RINGS.

IF ENGINE COOLANT TEMPERATURE BECOMES TOO LOW, RAW FUEL WILL WASH LUBRICATING OIL OFF CYLINDER WALLS AND DILUTE CRANKCASE OIL SO ALL MOVING PARTS OF THE ENGINE WILL SUFFER FROM POOR LUBRICATION.

STEP 1. THE ENGINE CAN BE SHUT DOWN COMPLETELY

Section VII. MAINTENANCE OF ENGINE COOLING SYSTEM COMPONENTS

-15. Radiator Inspection and Service

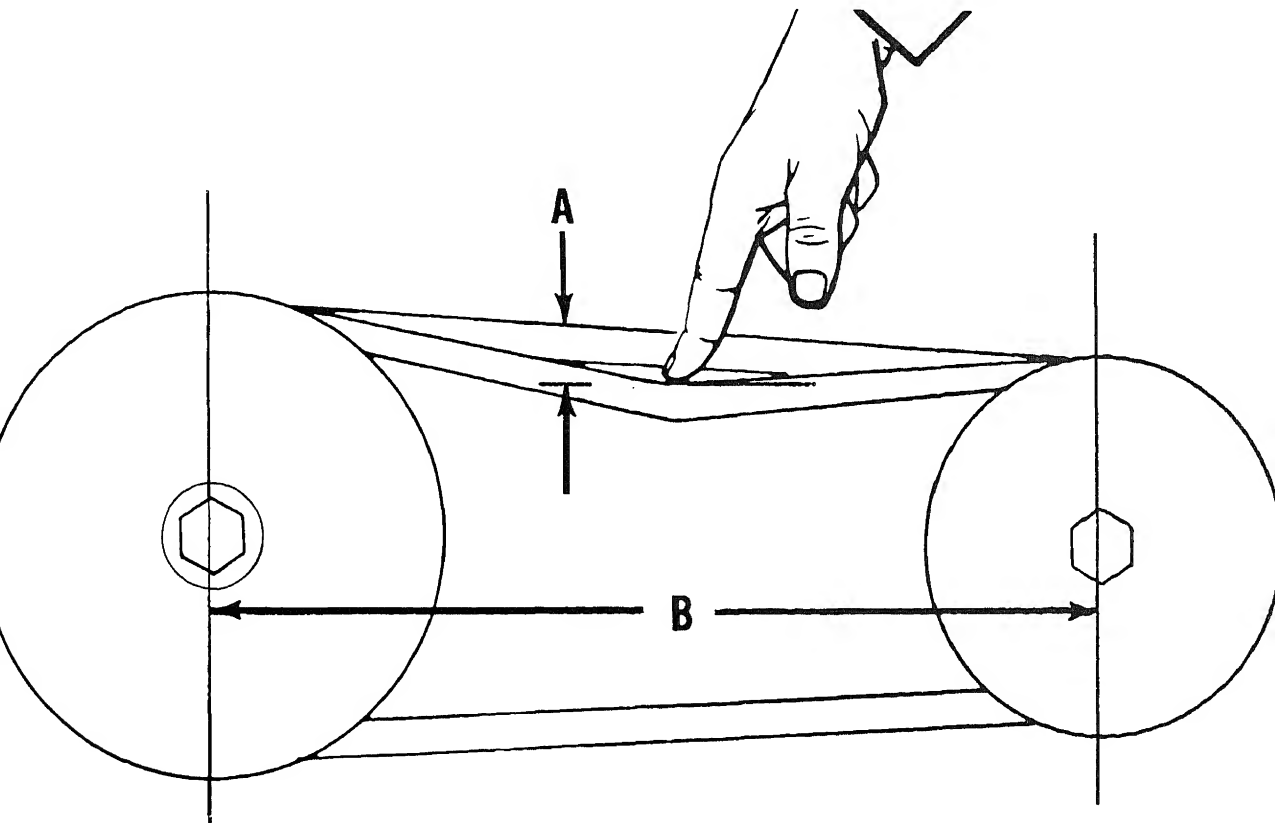
a. Check coolant level in radiator. Proper level is 2 inches below filler neck.

b. Check radiator for leaks, dents, and other damage.

-16. Fan Belt Inspection and Service

a. Inspect the belt frequently for proper tension, cracks, and wear.

b. Tighten belt so pressure of index finger extended straight down will depress belt (A, fig. 3-8) to value shown. Force applied will be approximately 13 lbs for each foot of belt free span (B, fig. 3-8). The fan belt is 11/16 inches wide.



BELT WIDTH
IN.

DEFLECTION PER FT. OF SPAN
IN.

1/2

13/32

13/32

Section VIII. MAINTENANCE OF ELECTRICAL SYSTEM COMPONENTS

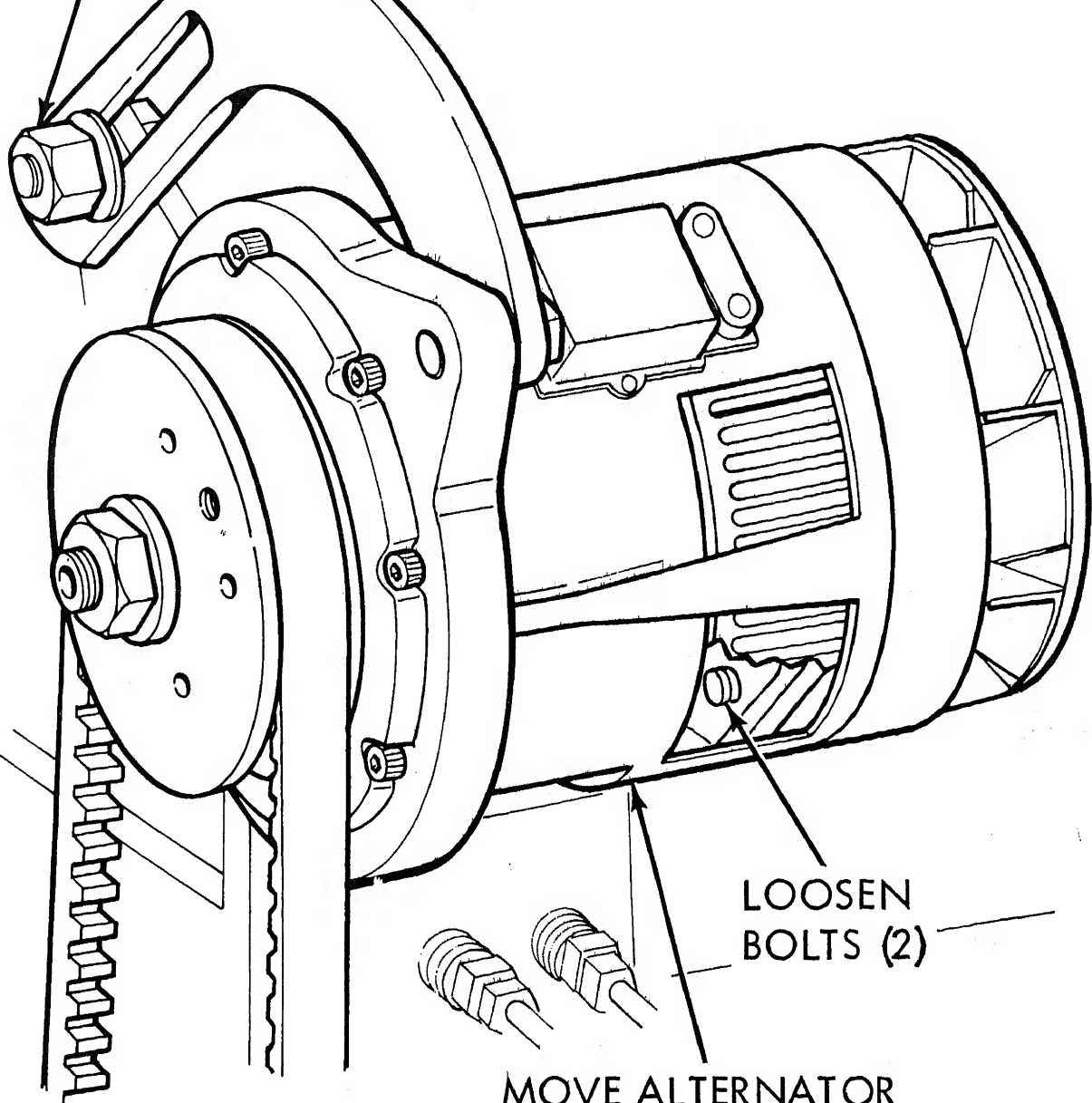
3-17. Alternator Belt Inspection and Adjustment

- a.* Inspect alternator belt frequently for proper tension, cracks and wear.
- b.* Refer to figures 3-8 and 3-9 and adjust alternator belt.

3-18. Starting Motor Service

Every 200 hours, add at least 3 to OE-30 lubrication oil in each oil reservoir.

LOOSEN BOLT



LOOSEN
BOLTS (2)

MOVE ALTERNATOR
UP TO TIGHTEN BELT

Section IX. MAINTENANCE OF TRANSMISSION ASSEMBLY

19. Inspection

Inspect transmission assembly for evidence of

leakage. Report leaky transmission to organizational maintenance.

Section X. MAINTENANCE OF WHEELS AND TRACKS

20. Track Support Rollers and Brackets

a. Inspection.

(1) Make sure rollers and brackets are securely mounted.

(2) Check for proper lubrication of rollers and evidence of wear.

b. Service. Lubricate rollers in accordance with lubrication order.

21. Track Idlers and Brackets (fig. 3-10 and 3-11)

a. Inspection.

(1) Make sure idlers and brackets are securely mounted.

(2) Check for proper lubrication and for evidence of wear.

b. Service. Lubricate track idlers in accordance with lubrication order.

22. Track Assembly

a. Inspection.

(1) Watch the belts closely when the ma-

chine is working in loose dirt, sand, or mud, and loosen the adjustments of the belt if the dirt takes up all the slack. Propelling with tight belt is extremely hard on the propelling machinery.

(2) See that tracks are free before moving machine. Check closely in freezing weather.

(3) Check condition of track, links, and pins. Check pins and keeper pins to see that they are secure.

b. Adjustment (fig. 3-12).

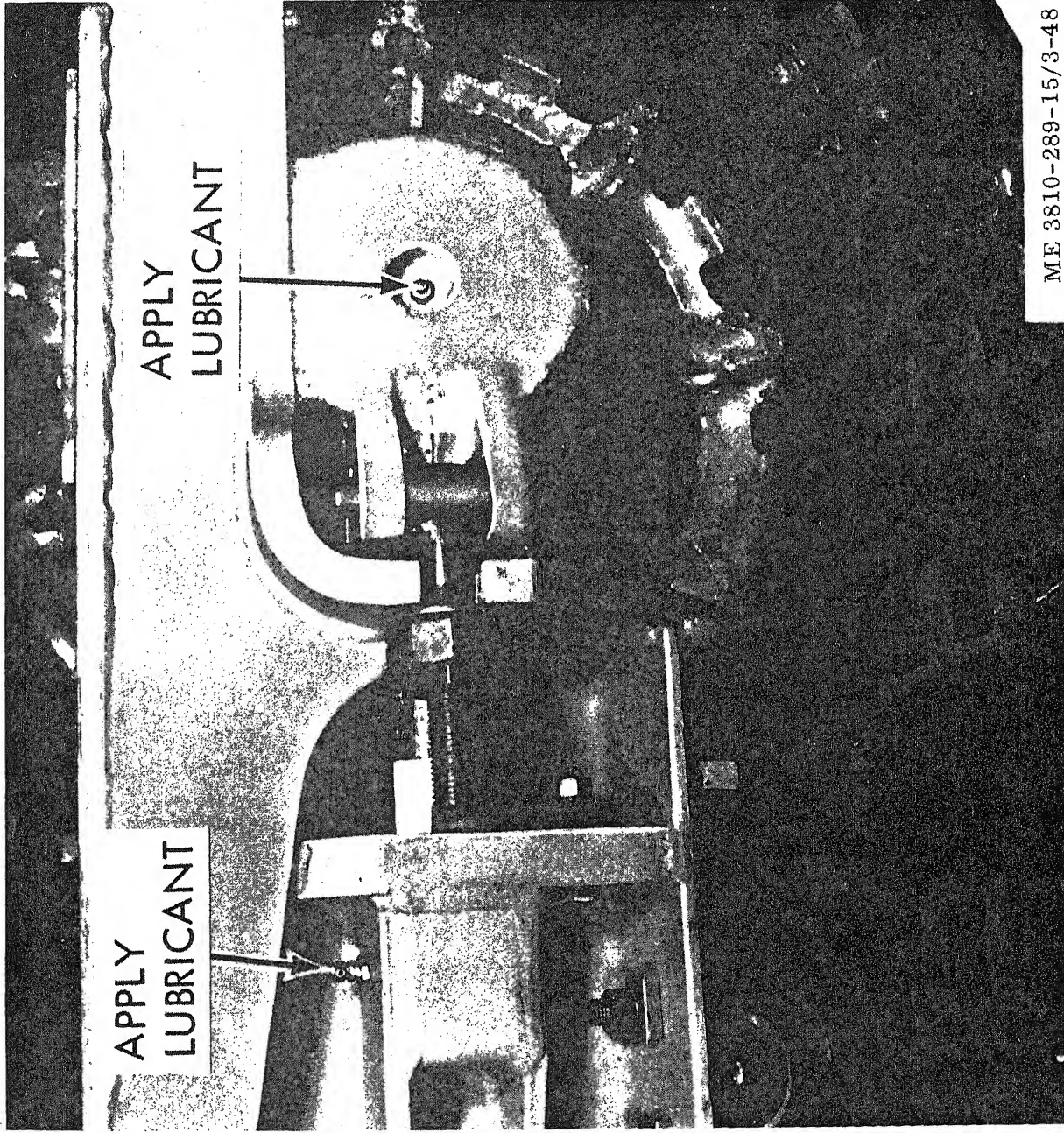
(1) Loosen the takeup tumbler shaft clamping bolts (opposite chain drive end). Remove the adjusting screw nut locks and turn the adjusting nuts until the correct adjustment is obtained (4-5 inch slack of upper belt section).

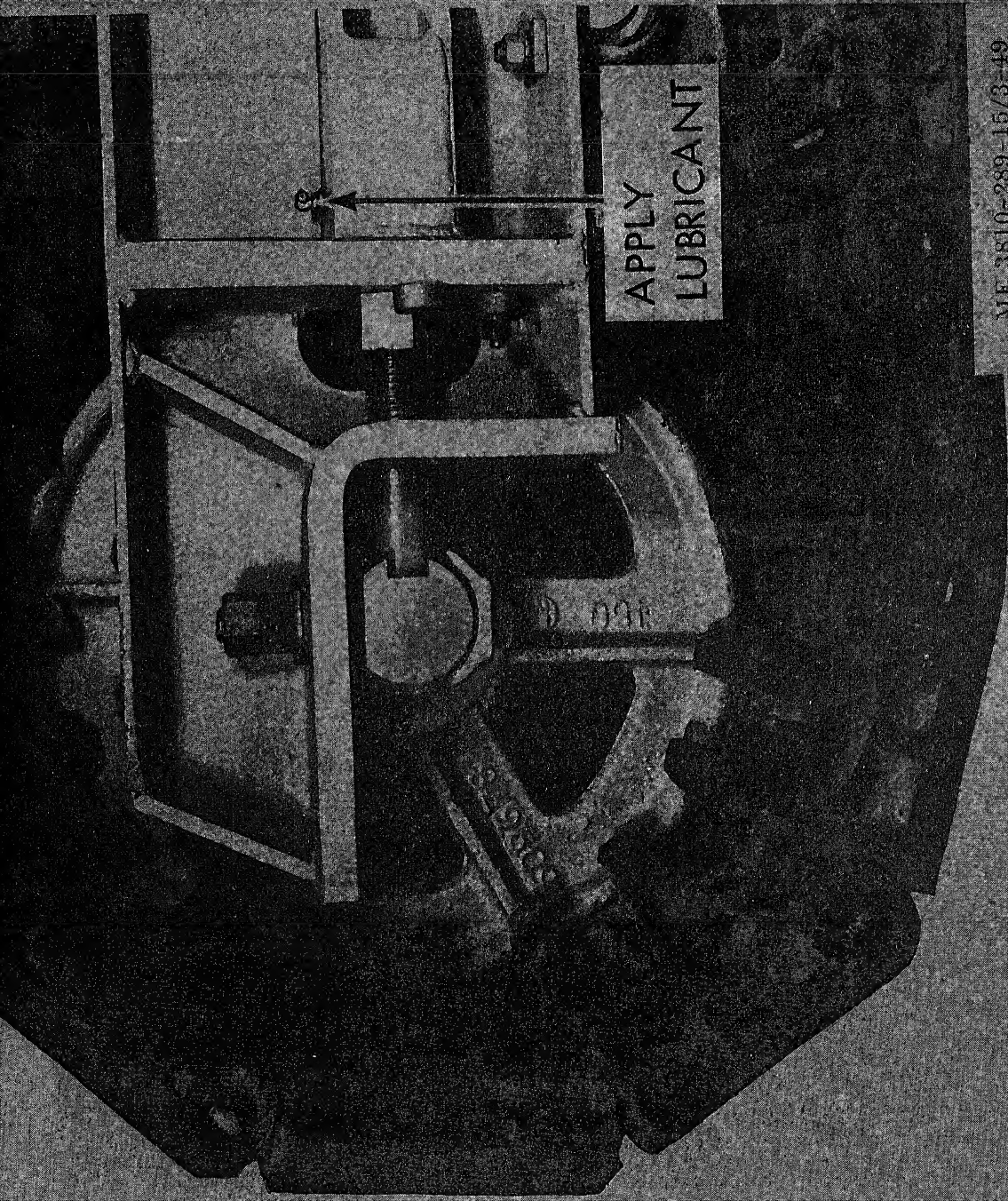
(2) Turn the adjusting nuts on both sides of the track frame the same amount, to keep the takeup tumbler shaft parallel to the front of the track frame.

(3) After adjustment, replace the adjusting nut locks and retighten the clamping bolts.

APPLY
LUBRICANT

APPLY
LUBRICANT





ME 3810-289-15/3-49

LOOSEN LOCKING
NUTS

ADJUST RIGHT AND
LEFT TUMBLERS AN
EQUAL AMOUNT

TURN ADJUSTING
NUT

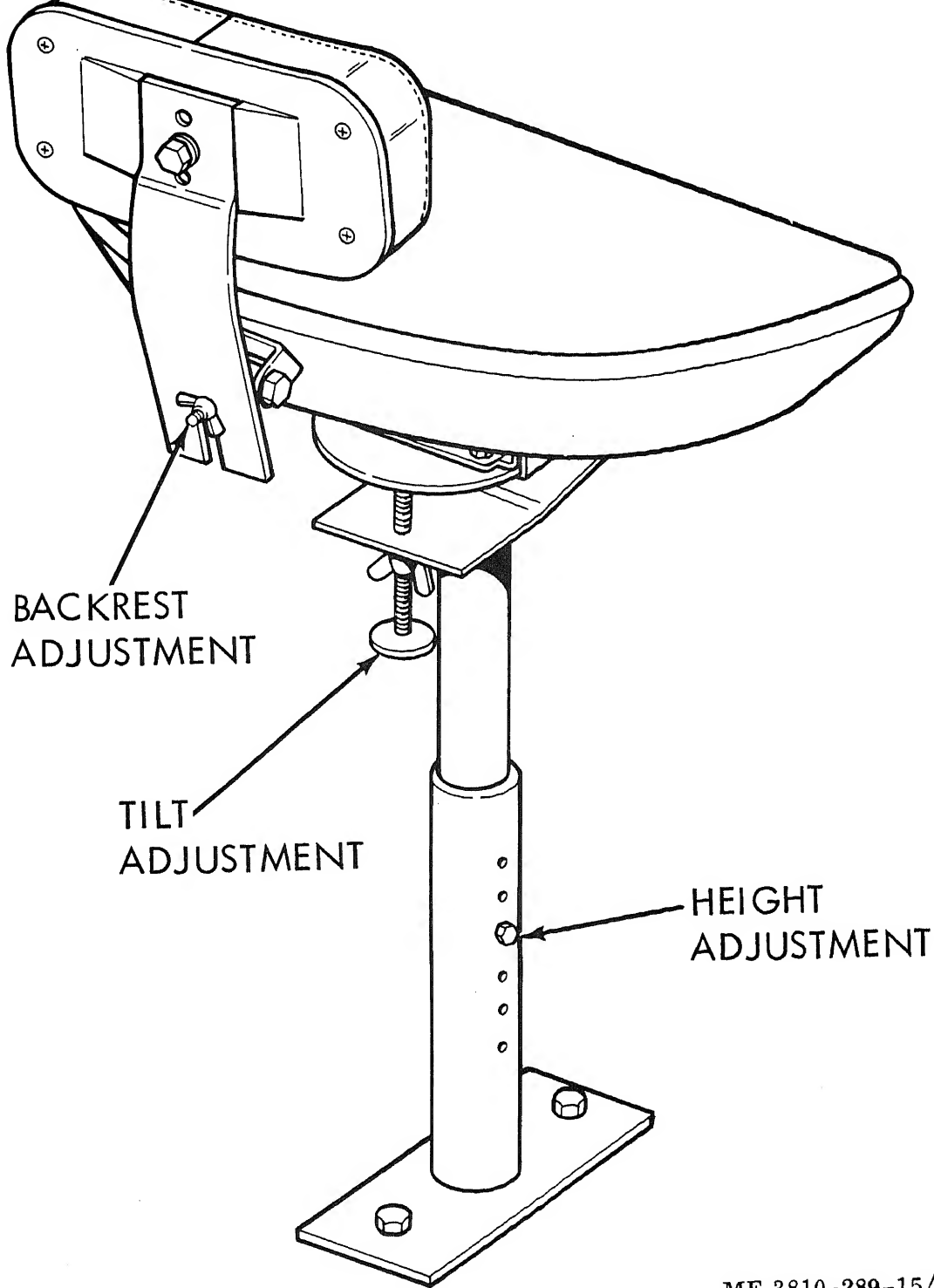
Section XI. MAINTENANCE OF CAB COMPONENTS

3—23. Cab Assembly Inspection

- a.* Check for cracks and loose bolts.
- b.* Check for proper operation of doors and hinged panels.

3—24. Seat Assembly Adjustment

Refer to figure 3-13 to adjust the bly.



Section XII. MAINTENANCE OF CRANE, SHOVEL, AND EARTHMOVING EQUIPMENT COMPONENTS

3-25. Cable Harness and Cable Inspection

Examine cables frequently for flats or broken wires.

3-26. Crane Boom Assembly Inspection and Service

a. Inspection.

(1) Lower the boom and support on cribbing (fig. 3-14).

(2) Spool off a few turns of the suspension and hoist ropes so boom point sheaves can be rotated by hand.

(3) Examine all sheaves for side wear of rope grooves.

(4) Inspect block and hook for secure mountings and proper lubrication.

(5) Inspect crane boom for bent or damaged cords and lacings and for loose bolt mountings of butt joints. Tighten loose bolts; replace missing bolts.

(6) Inspect the boom foot pins; make sure they are secure.

b. Service. Lubricate all points on boom and hook block in accordance with lubrication order.

3-27. Operating Clutches Inspection, Service, and Adjustment

a. General. Operating clutches (fig. 3-15 and 3-16) should hold securely when engaged and be completely free when levers are in neutral position.

b. Inspection.

(1) Check linkage and shifter yokes for wear and damage. See if all connecting pins and bolts are secure.

(2) See if shifter yoke reach arms are adjusted so that clutches fully engage and release. Adjust if necessary (para 3-11).

c. Service.

(1) Remove oil and grease from lining and

d. Adjustment (fig. 3-16).

(1) Set clutch in engaged position.

(2) Adjust eyebolt until the gap between lugs (of toggle-link and bellcrank) at the spring bolt is no more than $\frac{1}{8}$ inch with the clutch coiled. If clutch is adjusted while hot, the gap should be smaller than $\frac{1}{8}$ inch.

(3) Adjust guide screws so band clears housing by about $\frac{1}{32}$ inch all the way around when clutch is released.

(4) Adjust the dead end screw to provide about $\frac{1}{32}$ inch clearance between the lining and housing when clutch is disengaged.

3-28. Steering Spline Clutch Adjustment

Adjustment should seldom be required, but if needed, adjust the reach rods in the bevel gear case (fig. 3-17). With the steering spline clutch lever in neutral, the reach rod lengths should be adjusted so that both clutches are in full engagement.

3-29. Boom Hoist Clutch Band Inspection and Adjustment

a. Inspection.

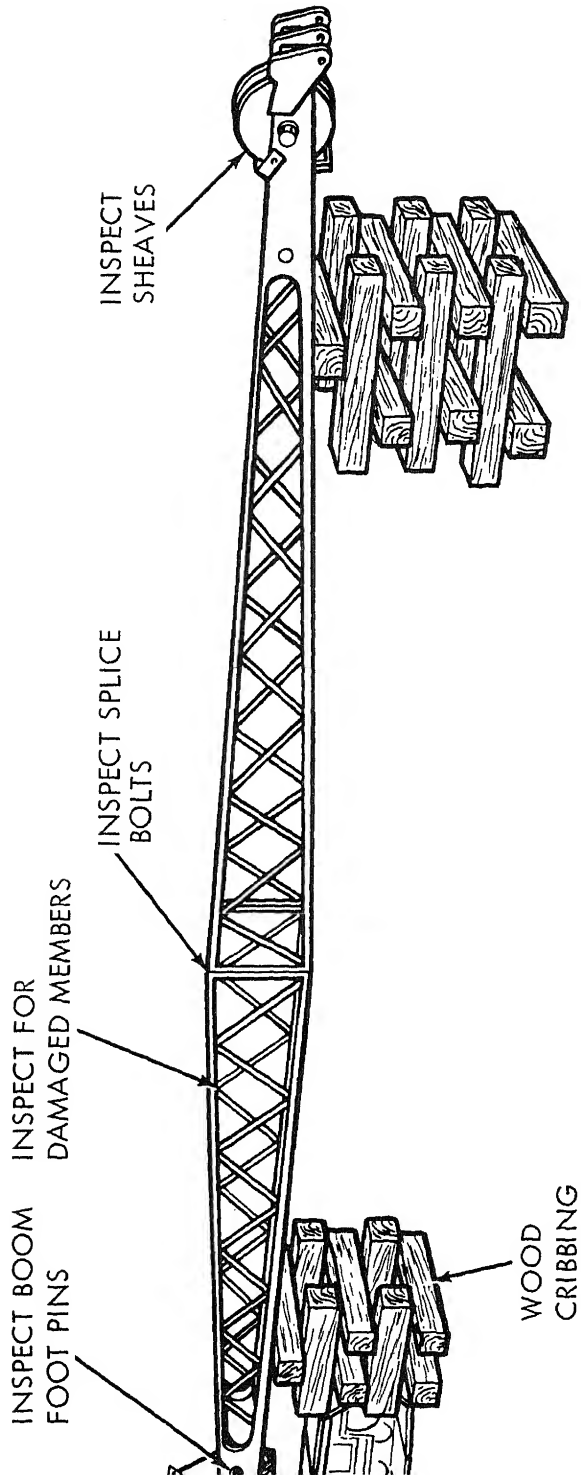
(1) Inspect boom hoist clutch and booster bands for wear or damage. If satisfactory operation cannot be obtained by adjustment, worn bands should be replaced.

(2) Report defective or worn band to organizational maintenance.

b. Adjustment.

(1) *Booster band.* With control lever in neutral position, adjust booster clutch band wear adjustment nuts until booster band will have minimum clearance all around its housing and engage the main clutch on pulling hand lever. A good way to determine sufficient clearance is to have grasp the booster band at joint. If it can be moved sideways freely, clearance should be satisfactory.

(2) *Main clutch.* Adjust the main clutch



ME 3810-289-15/3-57

Figure 3-14. Boom assembly inspection.

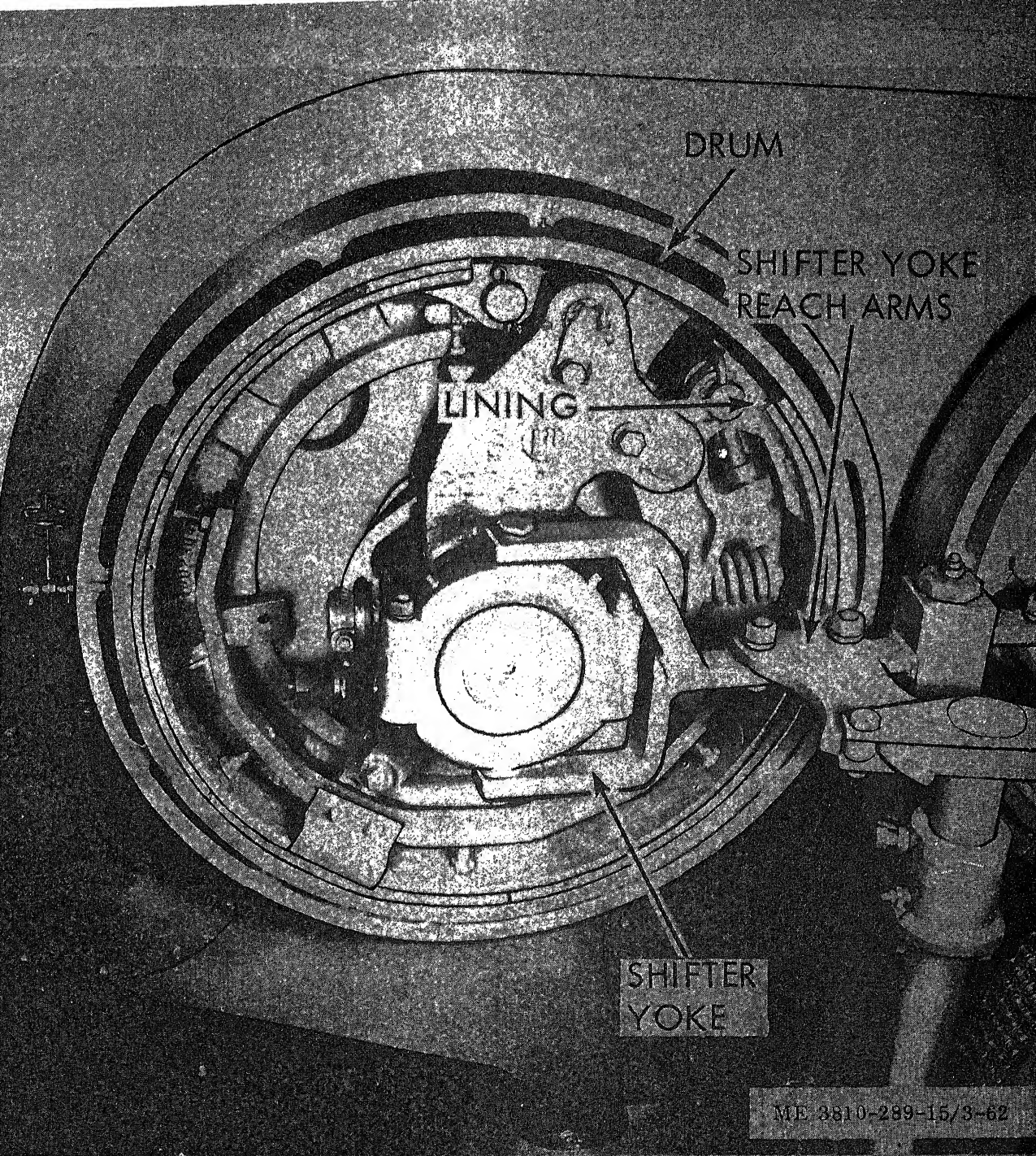
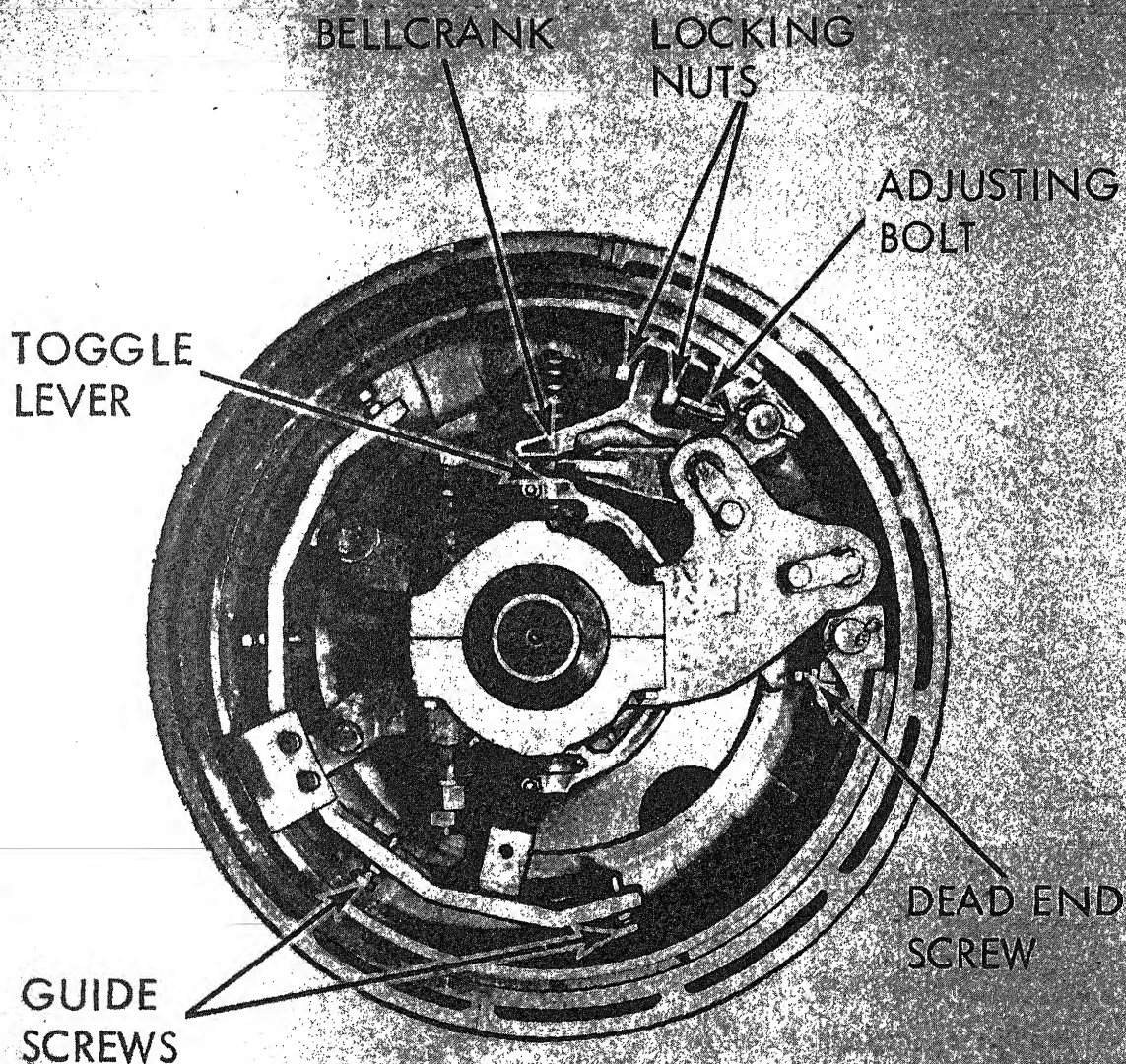


Fig. 2-15 Conventional clutch operation



ME 3810-289-15/3-63

Figure 3-16. Operating clutch adjustment.

REMOVE COTTER
PIN AND YOKE PIN

LOOSEN NUT

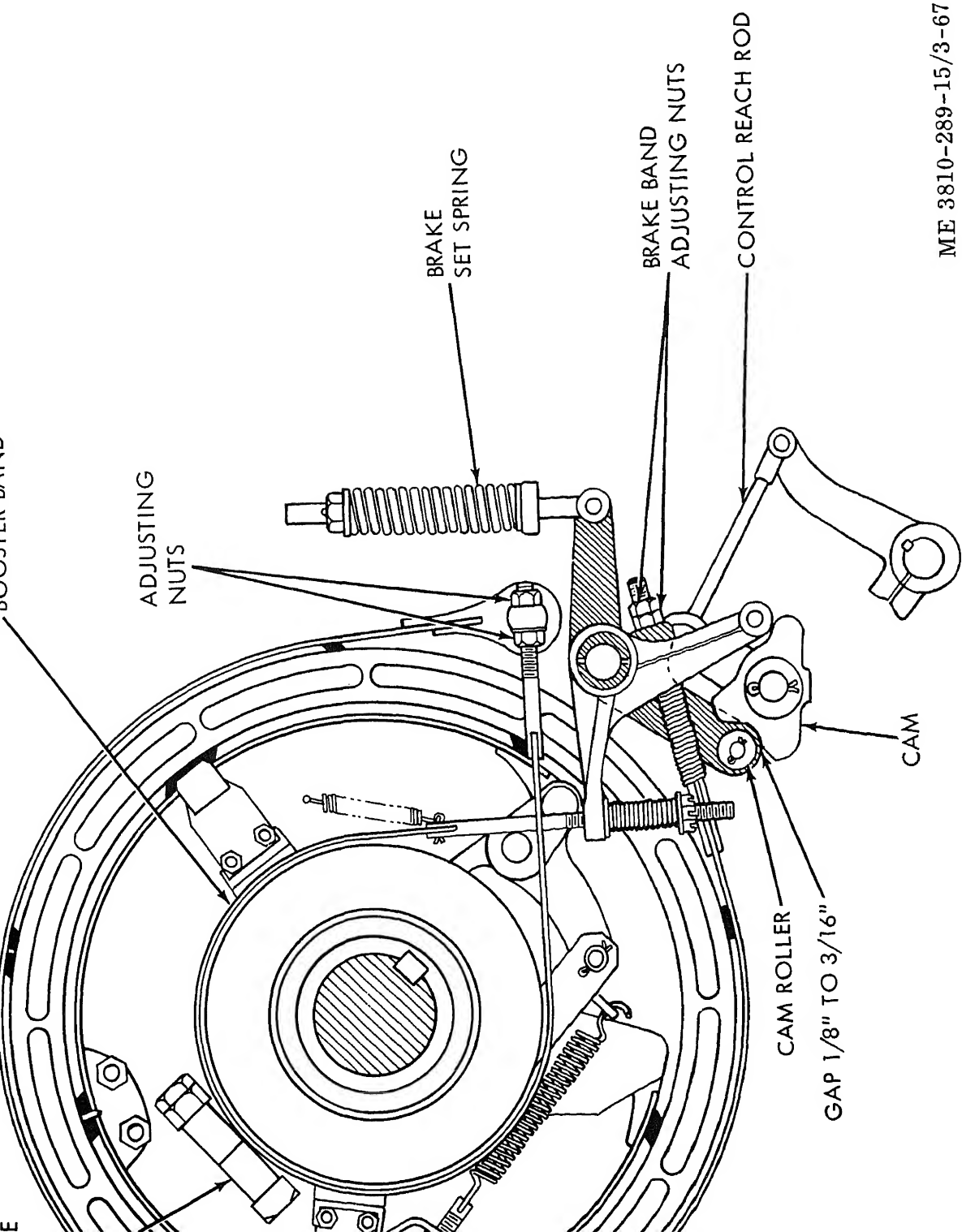
ADJUST
YOKE

LOOSEN
NUT

CLUTCH SHOULD BE
FULLY ENGAGED

REMOVE
COTTER PIN
AND YOKE PIN

ADJUST



b. *Adjustment (fig. 3-18).* Adjustment must be made in sequence as follows:

(1) With control lever in neutral position, adjust length of control reach rod until rear detent in cam is centered by brake cam roller.

(2) With control lever in neutral position, adjust brakeband wear adjustment nuts until gap is $\frac{1}{8}$ to $\frac{3}{16}$ inch (between cam rear detent faces and brake cam roller).

(3) The above adjustment must be made periodically as brake lining wears, to secure proper timing between clutch set and brake release during boom raising.

(4) The brake set spring, which supplies the brakeband setting force, is adjusted at the factory and should not require any further adjustment or loads within the rated capacity of the machine.

3-31. Digging Lock Inspection and Service

a. *Inspection.* The digging lock has no friction linings or springs to get out of adjustment. It will seldom require attention, but if it is not operating properly, place the digging lock lever in the forward notch of its quadrant and check to see that the two pawls (fig. 3-19) drop into full engagement with the ratchet teeth.

b. *Service.*

(1) Grind or file ends of pawls if a bur prevents full engagement.

(2) Clean and oil pawl pins so that the pawls move freely.

3-32. Chain Case Assembly Inspection and Service

a. *Inspection.* Inspect chain case for secure mounting and proper oil level.

b. *Service.*

(1) Tighten loose mounting.

(2) Fill chain case to proper oil level. Refer to lubrication order.

3-33. Center Gudgeon Bushing Service

3-34. Cone Roller Service

Refer to current lubrication order and lubricate the cone rollers as required.

3-35. Vertical and Horizontal Swing and Propel Shafts Inspection and Service

a. *Inspection.* Inspect shaft couplings and assemblies for wear or damage.

b. *Service.* Check for proper lubrication and lubricate if necessary. Refer to lubrication order.

3-36. Hoist Assemblies Inspection and Service

a. *Inspection.*

(1) *Boom hoist.* Check for proper operation and secure mounting. Proper operation, in the case, means the boom responds correctly to being raised or lowered according to the position of the boom hoist lever, and that, when the lever is placed in the neutral position, the boom hoist brake effectively holds the boom in position. If the boom continues to creep lower after putting the boom hoist lever in neutral, the boom hoist brake must be adjusted (para 3-30) or replaced. If the boom hoist clutch slips, it should be adjusted (para 3-29) or replaced.

(2) *Hoist.* The hoist should respond properly while raising or lowering a load. If the hoist clutch slips, it should be adjusted (para 3-29) or replaced.

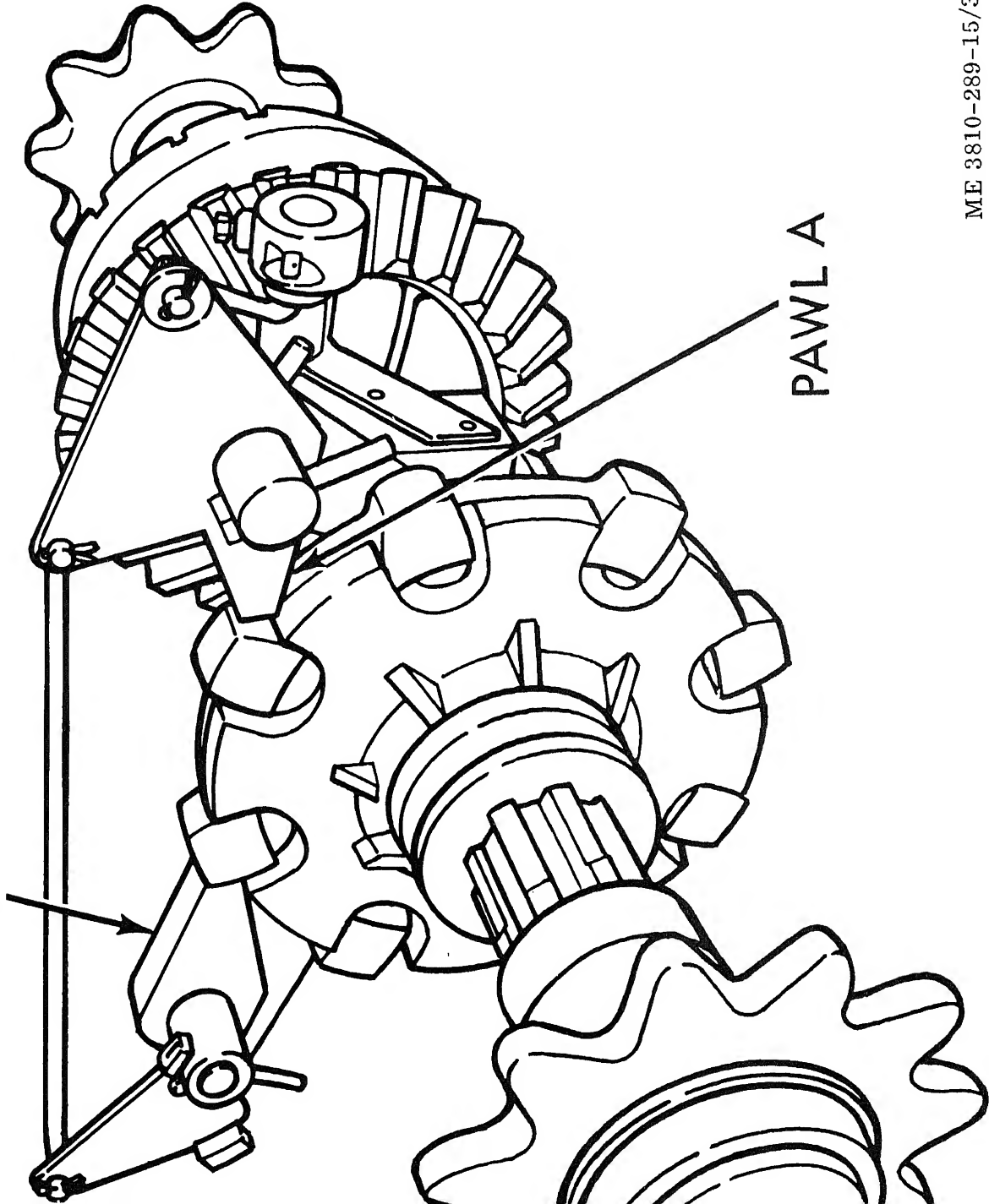
(3) *Lowering chain.* Check condition and tension of power load lowering chain and shorten if necessary. To shorten chain, remove connecting link by taking out cotter pins. Take off desired number of links and reconnect again with connecting link.

b. *Service.* Lubricate as required. Refer to lubrication order.

3-37. Piledriver Service

In normal operation with drop hammers, levers should be lubricated once per shift with open grade lubricant. After applying lubricant, run hammer

PAWL B



PAWL A

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-1. Tools and Equipment

Tools and equipment issued with or authorized for the crane-shovel are listed in the basic issue items list, appendix C.

4-2. Special Tools and Equipment

Special tools and equipment required for organizational maintenance are listed in table 4-

Table 4-1. Special Tools and Equipment

Item	FSN or part no.	Reference		Use
		Fig.	Para	
Belt tension gage	ST-968	4-20	4-32	Check belt tension.
Wrench adapter	ST-669	4-3	4-13	Adapts torque wrench to lock nuts of valve crossheads.

4-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in TM 5-3810-289-20P.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-4. General

This section contains instructions for preventive maintenance checks and services which must be performed by organizational maintenance personnel at quarterly intervals. A quarterly interval is equal to three calendar months, or 250 hours of operation, whichever occurs first.

4-5. Preventive Maintenance Checks and Services

Refer to table 3-1 for the quarterly preventive maintenance checks and services. The item numbers in the tabular list indicate the sequence of minimum requirements.

Section III. TROUBLESHOOTING

4-6. General

This section provides information useful in diagnosing and correcting unsatisfactory operation of the crane-shovel.

4-7. Troubleshooting Chart

In chart 4-1, each malfunction listed is followed by a list of probable causes. The corrective action required is described opposite the probable cause.

Chart 4-1. Troubleshooting

Malfunction	Probable cause	Corrective action
Engine fails to start.	<ul style="list-style-type: none"> a. Engine too cold. b. Lack of fuel. c. Clogged fuel filters. 	<ul style="list-style-type: none"> a. Use starting aid. b. Check fuel tank. c. Clean element in primary filter. Replace elements in final filter (para 4-23).
Irregular firing of engine.	<ul style="list-style-type: none"> a. Clogged fuel filter elements. b. Inlet or exhaust valves, improper adjustment. 	<ul style="list-style-type: none"> a. Clean element in primary filter. Replace elements in final filter (para 4-23). b. Adjust valves (para 4-12).
Engine overheating indicated.	<ul style="list-style-type: none"> a. Loose fan belts. b. Radiator clogging. c. Water temperature gage defective. d. Thermostats defective. e. Radiator sealed pressure overflow defective. 	<ul style="list-style-type: none"> a. Adjust fan belt (para 4-32). b. Clean radiator (para 4-31). c. Replace gage (57, fig. 4-31). d. Test thermostats (para 4-33). e. Clean or replace (para 4-31).
Engine knocks excessively.	<ul style="list-style-type: none"> a. Main bearings worn or burned out. b. Connecting rod bearings worn or burned out. 	<ul style="list-style-type: none"> a. Replace main bearings (report to direct support maintenance). b. Replace connecting rods (report to direct support maintenance).
Low or no lubricating oil pressure indication.	Defective gage.	Replace gage (56, fig. 4-31).
Low or no fuel pressure indication.	<ul style="list-style-type: none"> a. Clogged fuel filters. b. Defective gage. 	<ul style="list-style-type: none"> a. Clean element in primary filter. Replace elements in final filter (para 4-23). Replace gage (56, fig. 4-31).
Starter will not crank engine.	<ul style="list-style-type: none"> a. Batteries weak. b. Loose connection or defective wiring. c. Defective switch. d. Commutator dirty or worn. 	<ul style="list-style-type: none"> a. Test batteries and charge if necessary (para 4-46). b. Inspect and replace damaged wiring. Inspect all connections to starter, magnetic switch, ignition switch, and batteries. c. Inspect all switches to determine their condition. Connect jumper lead around any switch suspected of being defective; if system functions, replace the bypass switch. d. Inspect commutator by removing inspection plugs. If commutator is dirty or slightly grooved, polish by placing a strip of fine sandpaper around commutator and under brushes (rough side toward commutator) and rotate armature. Blow dust from com-

Malfunction	Probable cause	Corrective action
0. Batteries will not hold charge.	<ol style="list-style-type: none"> Short in electrical system. Defective battery. Alternator regulator not operating properly. 	<ol style="list-style-type: none"> Check cables and wiring. Replace defective battery (para 4-46). Refer to paragraph 4-35.
1. Floodlights and/or dash light will not light.	<ol style="list-style-type: none"> Bulb burned out. Defective circuit breaker. Loose connection. Electrical system disconnect switch is in OFF position. 	<ol style="list-style-type: none"> Replace bulb (para 4-43). Replace circuit breaker. Tighten connections. Turn switch to ON position.
2. Cables wear excessively.	Cables of wrong specification.	Check for correct specifications.
3. Clamshell bucket fails to close.	Tooth in bucket twisted.	Replace tooth (para 4-60d).

Section IV. RADIO INTERFERENCE SUPPRESSION

4-8. General Methods Used to Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for the stray currents. The methods used include shielding the ignition and high-frequency wires, grounding the frame with bonding straps, and using capacitors and resistors.

4-9. Interference Suppression Components

a. Primary Suppression Components. The primary suppression components are those whose primary function is to suppress radio interference.

b. Secondary Suppression Components. The secondary suppression components have radio interference suppression functions which are incidental or secondary to their primary function.

4-10. Replacement of Suppression Components

a. General. Replacement of suppression components requires positive metal-to-metal contact with washers and ground straps.

b. Replacement. Replace defective suppression components.

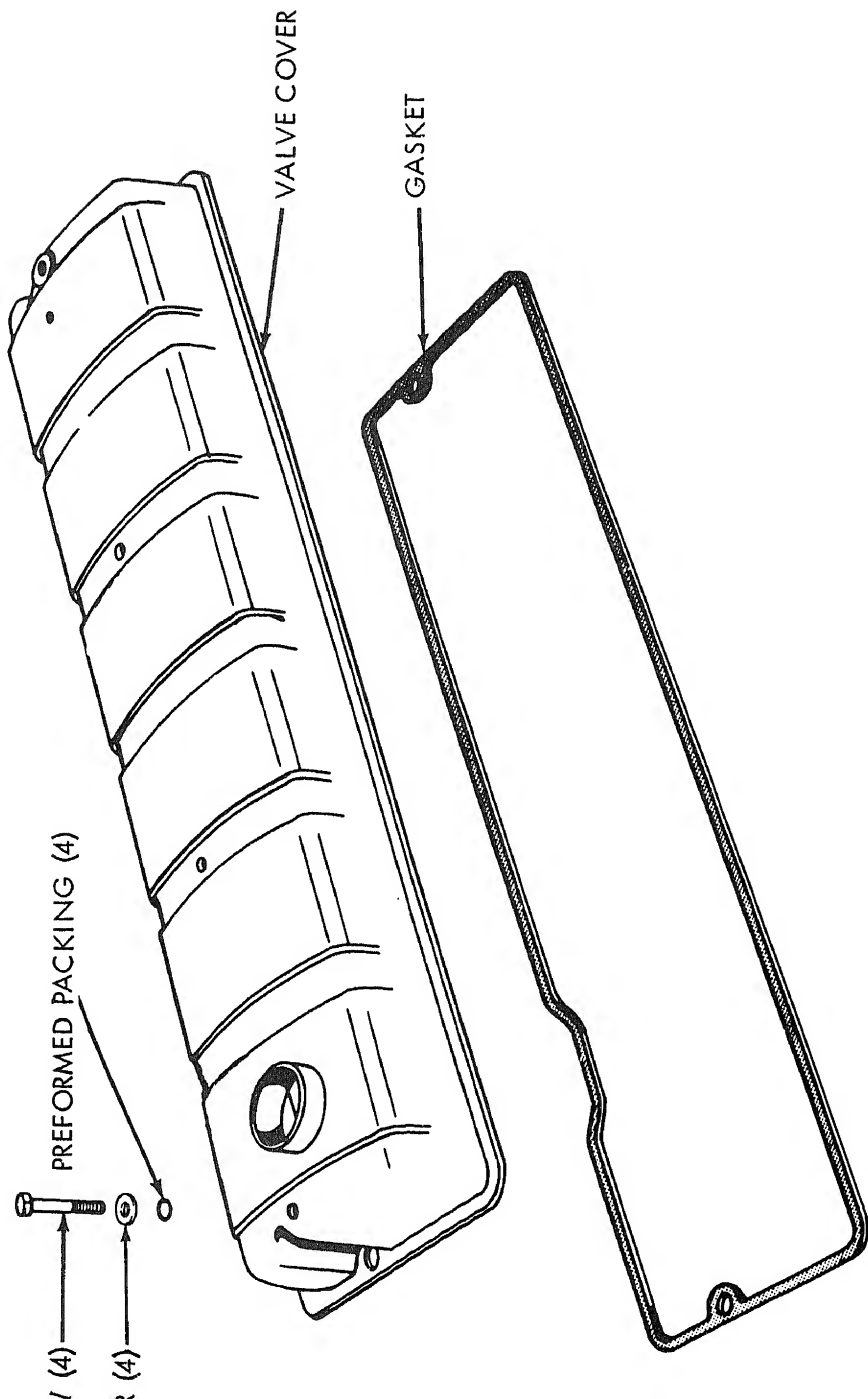
4-11. Testing of Radio Interference Suppression Components

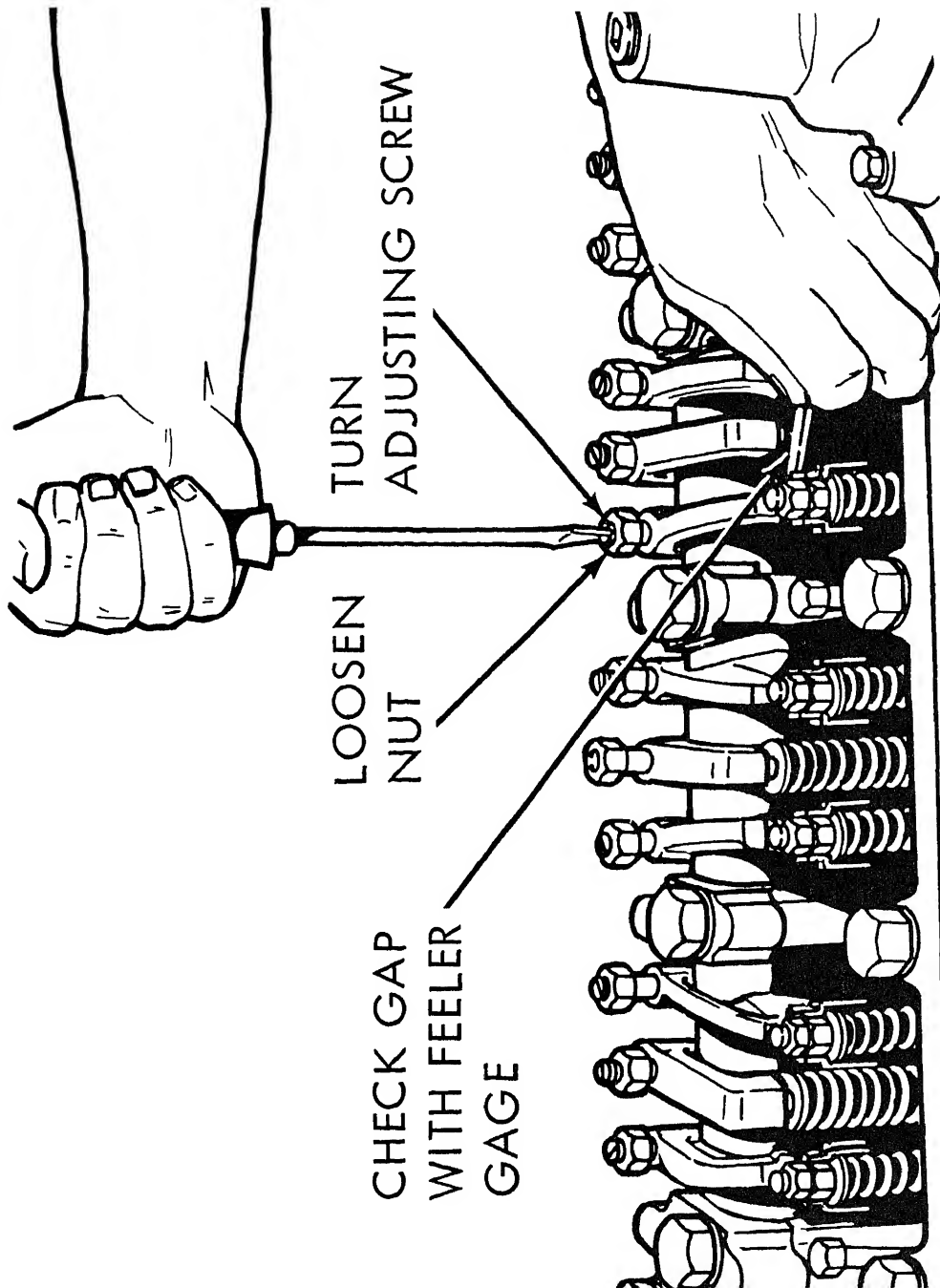
Test capacitors for leaks and shorts on a capacitor tester; replace defective capacitors. If test equipment is not available and interference is indicated, isolate the cause of interference by trial and error method of replacing each capacitor in turn until the cause of interference is located and eliminated.

Section V. MAINTENANCE OF ENGINE CYLINDER HEAD AND VALVE MECHANISM

4-12. Valve Cover and Gasket

(1) Remove all gasket material from sealing

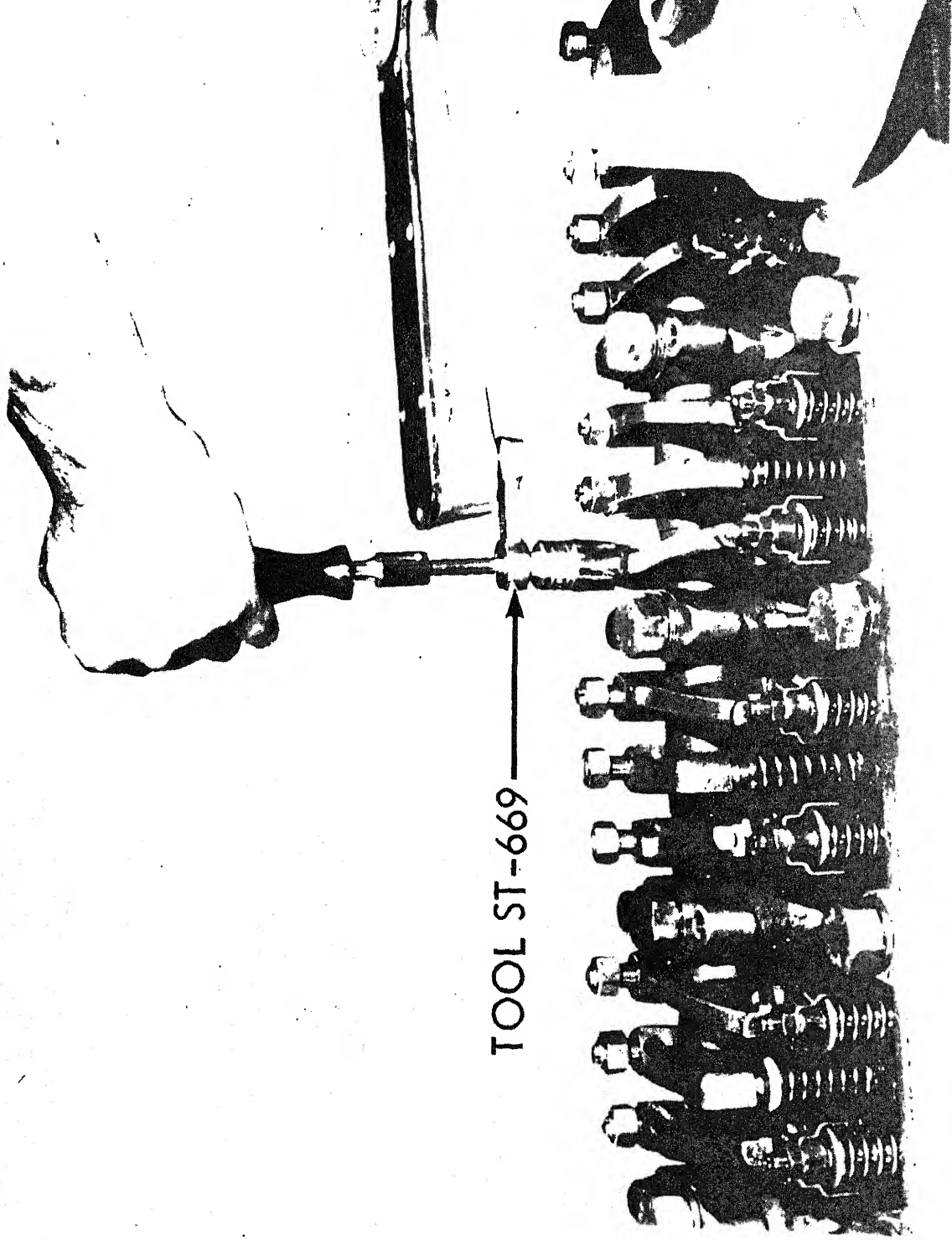




ME 3810-289-15/3-6

Figure 4-2. Rocker arm adjustment (tappet clearance).

TOOL ST-669



—13. Rocker Arm Assembly Adjustment

a. Loosen locknut and back off adjustment screw (fig. 4-2). Insert feeler gage between rocker lever and top of valve stem or crosshead. Turn screw down until lever just touches feeler gage; lock adjusting screw in this position with locknut.

b. Torque locknut to 60/70 foot-pounds (fig. 4-3).

c. Always make final valve adjustment with the engine at operating temperature (para 1-7). Valve tappet clearances are 0.015 inch (intake) and 0.025 inch (exhaust).

Section VI. MAINTENANCE OF ENGINE OIL COOLER AND OIL FILTER ASSEMBLY, AND MAIN CLUTCH ADJUSTMENT

—14. Oil Cooler

a. *Removal and Disassembly.*

(1) Refer to figure 4-4 and remove oil cooler.

(2) Refer to figure 4-5 and disassemble the oil cooler.

b. *Repair.*

(1) Repair damaged tubes by inserting a smaller o.d. (outside diameter) tube inside damaged tube. Do not restrict more than 5 percent of total number of tubes in this manner.

(2) If more than 5 percent of tubes are defective, discard element.

Caution: Do not damage adjacent tubes with heat while soldering.

c. *Reassembly and Installation.*

(1) Refer to figure 4-5 and reassemble oil cooler.

(2) Refer to figure 4-4 and install oil cooler.

4-15. Oil Filter Assembly

a. *Removal and Disassembly.* Remove and disassemble oil filter (fig. 3-1).

b. *Cleaning, Inspection and Repair.*

(1) Clean parts with an approved cleaning solvent.

(2) Inspect for cracks, breaks, and other damage.

(3) Replace defective parts.

c. *Reassembly and Installation.* Reassemble and install oil filter assembly (fig. 3-1).

4-16. Clutch Adjustment

a. Remove handhole cover (fig. 3-3).

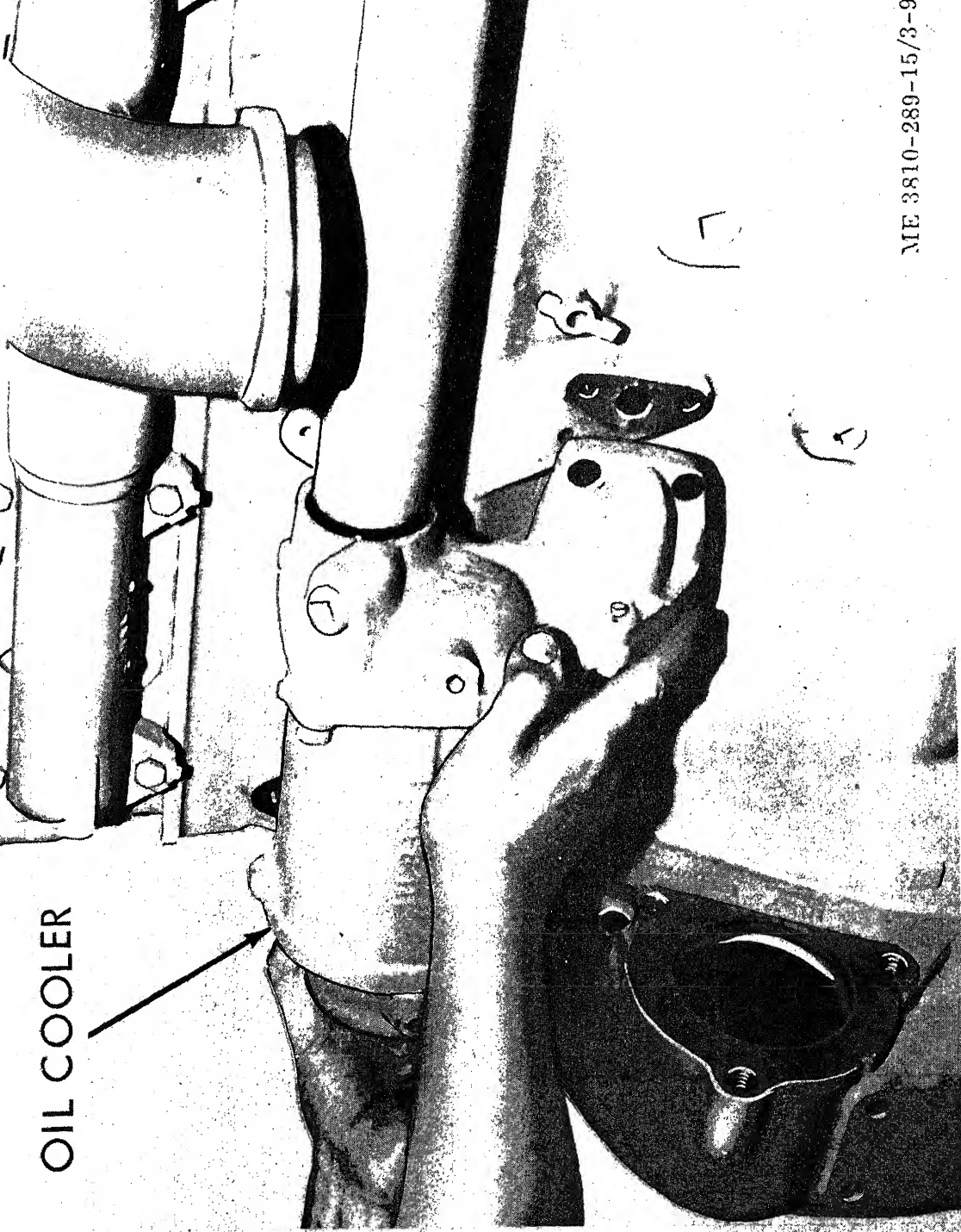
b. Turn clutch until adjusting lockpin can be reached.

c. Disengage the pin and turn adjusting yoke clockwise until pin will seat in a new hole.

d. Turn adjusting yoke one hole at a time until any tendency of the clutch to slip under normal load conditions is overcome.

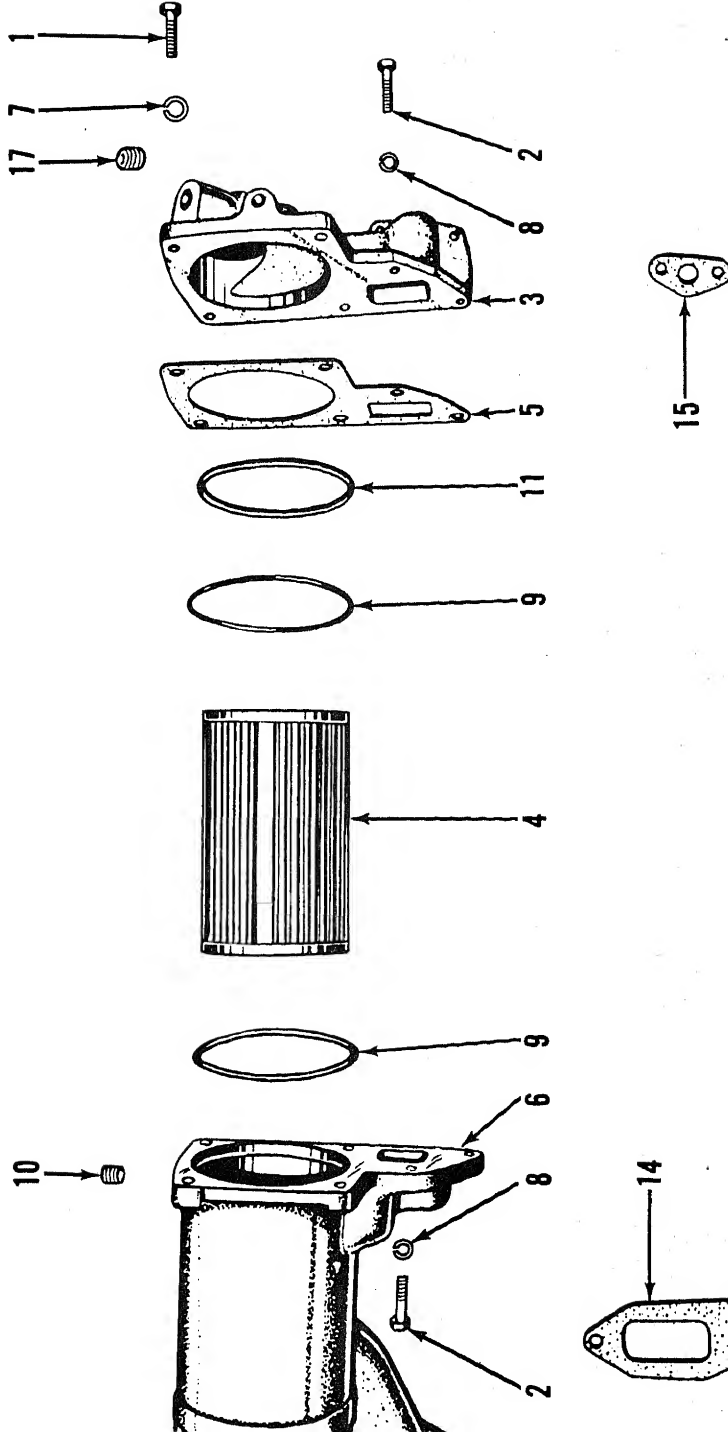
e. Install handhole cover.

OIL COOLER



NIE 3810-289-15/3-9

Figure 4-4. Oil cooler, removal and installation.



OIL COOLER DISASSEMBLY

ME 3810-289-15/3-10

- 13 Capscrew, cooler to block
- 14 Gasket, cooler to block (rear)
- 15 Gasket, cooler to block (front)
- 16 Lockwasher, housing to block

- 7 Lockwasher, cover to housing (4)
- 8 Lockwasher (6)
- 9 O-ring (2)
- 10 Pipe plug

- Capscrew, cover to housing (4)
- Capscrew (5)
- Lubricating oil cooler cover Element

Section VII. MAINTENANCE OF CLUTCH RELEASE MECHANISM CONTROL LEVERS, AND TURNTABLE SWING LOCK

4-17. Control Levers

Refer to figure 3-4.

a. Removal.

(1) Remove any grease fittings likely to be damaged in disassembly.

(2) Remove any springs in the assembly.

(3) Remove reach rods. Most reach rods have an adjusting arrangement at one end. Do not disassemble this adjusting arrangement unless necessary and then retain setting if possible. If parts are not to be replaced immediately, mark adjustment setting so it can be re-made if accidentally disturbed. If a number of controls are disassembled at the same time, number the reach rods from left to right of machine (taking left as operator's left as he sits in his seat facing controls), to save time on reassembly. While off from machine, be sure reach rods are placed in a safe place where they are not likely to be bent. Replace pins and cotter pins in rods for convenience in reassembly.

(4) To remove bellcranks, remove their fulcrum pins. If fulcrum pin is headed with nut behind bellcrank brackets, it is sometimes more convenient to remove the bracket bolts and then disassemble the crank from bracket by removing fulcrum pin.

(5) Control shafts (these are fulcrums for grouped levers) slide out after members locked to shaft have been freed by loosening clamp bolts and opened by inserting a small wedge in slot. Before removing, number the units on the shaft (front left to right) for convenience in reassembly.

b. Installation.

(1) Insert control shafts (fulcrums for grouped levers), through holes in operating levers and bearings in revolving frame. Remove wedges from slots in levers and tighten lever clamp bolts just enough to support levers. Tighten bolts when final adjustment is made.

(2) Bolt on bellcranks, being sure to place them in correct position.

(3) Attach reach rods, checking to be sure original adjustment is retained. If reach rod to be replaced and original length is still apparent, adjust new rod to match old before inserting. If original rod is badly bent or destroyed set a new rod. Fasten both control and operating lever in neutral position and adjust reach rod to make proper connection. Call change to attention of operator who will have to make final adjustment after experimenting with operating performance.

(4) Attach springs.

(5) Check to be sure all clamp connections are securely tightened, and that cotter pins are safely spread. Safe operation of the machine depends on a reliable control system.

c. Adjustment. Adjust linkage by tightening or loosening adjusting nuts on rod ends or adjustable devices until levers are in a vertical position when in neutral and aligned with each other in the main lever bank.

4-18. Swing Lock

Refer to figure 4-6.

a. Removal.

(1) Remove toggle springs and detach control reach rod which is attached with two cotter pins and washers.

(2) Remove pin connecting short toggle link to eyebolt in locking-dog.

(3) Remove pin from one end of locking-dog shaft and slide out shaft.

(4) Remove pin connecting long toggle link to center casting.

(5) Remove center pin from toggle linkage.

(6) Remove eyebolt from locking-dog, note original position so same adjustment can be secured when locking-dog is reassembled.

LOCKING DOG

LOCKING DOG SHAFT

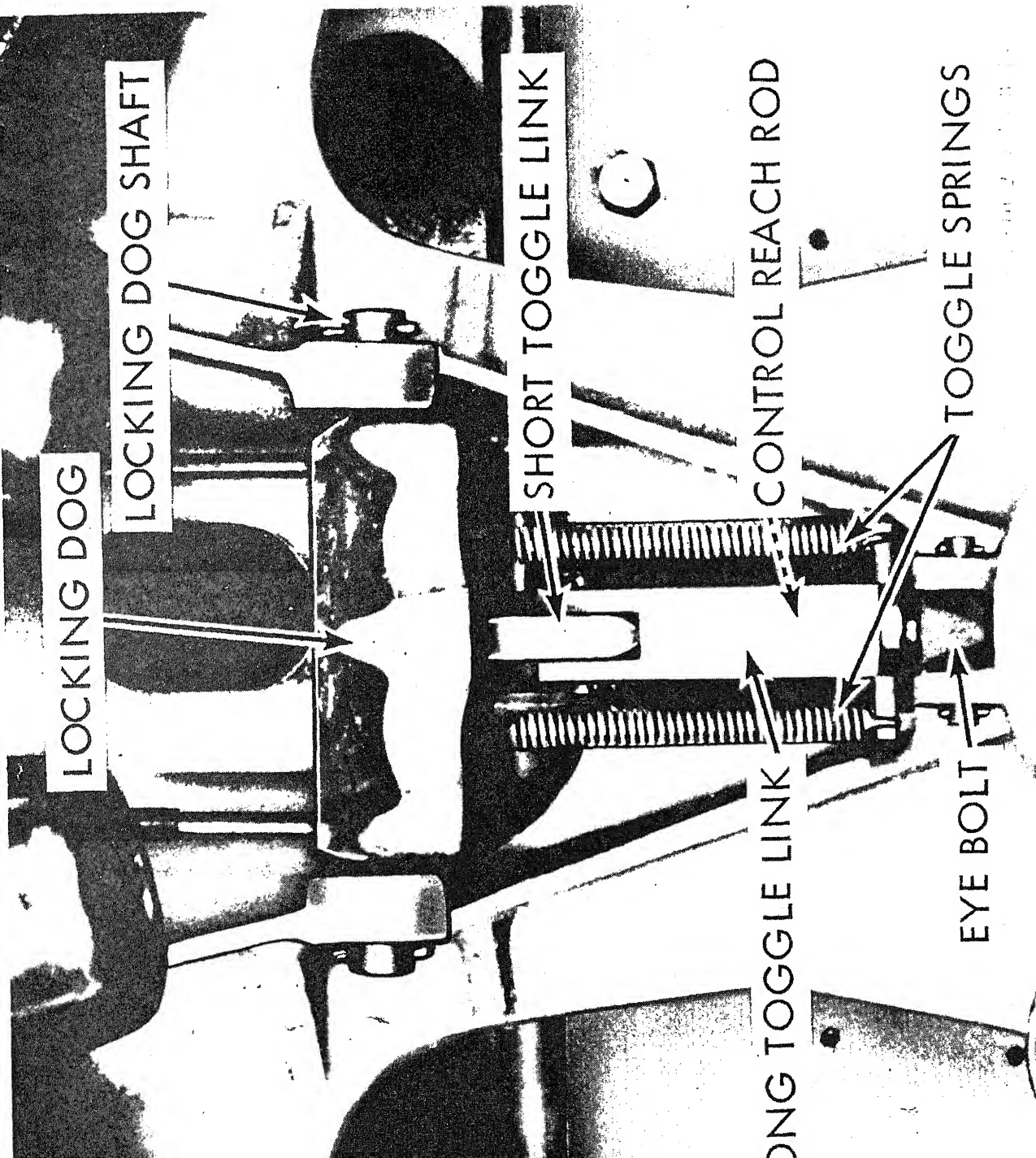
SHORT TOGGLE LINK

CONTROL REACH ROD

TOGGLE SPRINGS

LONG TOGGLE LINK

EYE BOLT



b. Installation.

- (1) Insert eyebolt in locking-dog in original position if engagement has been satisfactory.
- (2) Place locking-dog in frame, insert shaft and lock with two cotter pins.
- (3) Assemble two toggle links with toggle link pin (14) and cotter pin.

(4) Place split end of short toggle link over eyebolt (18), insert pin and lock with cotter pin.

(5) Insert end of long link in recess in cotter casting, insert pin and lock with cotter pin.

c. Adjustment of Swing Lock Levers. Refer to paragraph 3-12.

Section VIII. MAINTENANCE OF ENGINE FUEL SYSTEM COMPONENTS

4-19. Fuel Pump Service

Refer to figure 4-7 and service the fuel pump filter screen.

4-20. Fuel Lines, Fittings, Shutoff Valve Replacement

Refer to figures 4-8, 4-9 and 4-10 to replace the fuel lines and fittings.

4-21. Shutdown Valve Replacement

a. Removal.

(1) Refer to figure 4-11 and remove the shutdown valve.

(2) Discard preformed packing.

b. Installation. Refer to figure 4-11 and install the shutdown valve, using new preformed packing.

4-22. Air Cleaner Service and Replacement

a. Regular service intervals, along with close visual inspection of the dry-type air cleaner, are necessary for proper cleaning of the engine inlet air. The service interval will vary with the weather and working conditions. Where dust conditions are severe, it will be necessary to service the air cleaner frequently. Refer to paragraph 3-13 and service the air cleaner.

b. Refer to figure 4-12 and replace the air cleaner.

4-23. Fuel Filters, Service and Replacement

a. Refer to figure 4-13, disassemble, as necessary, to replace or clean the fuel filters.

b. Discard filter cartridge assemblies.

c. Wash strainer element (7) and filter body in an approved cleaning solvent; blow dry with compressed air.

4-24. Primer Assembly Replacement

Refer to figure 4-14 and replace the primer unit, lines and fittings.

4-25. Throttle Control Replacement

Refer to figure 4-15 to replace the throttle control.

4-26. Tank Cap Strainer Service and Replacement

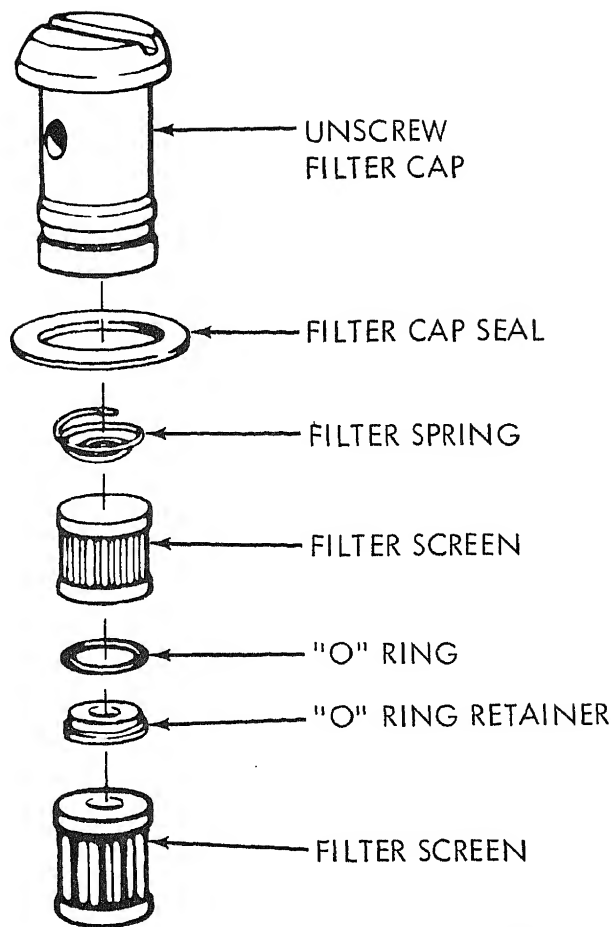
Refer to figure 3-7 and service and replace the fuel tank cap strainer.

4-27. Fuel Tank Inspection and Replacement

a. Inspect fuel tank for leaks and loose mounting bolts or fuel line connections.

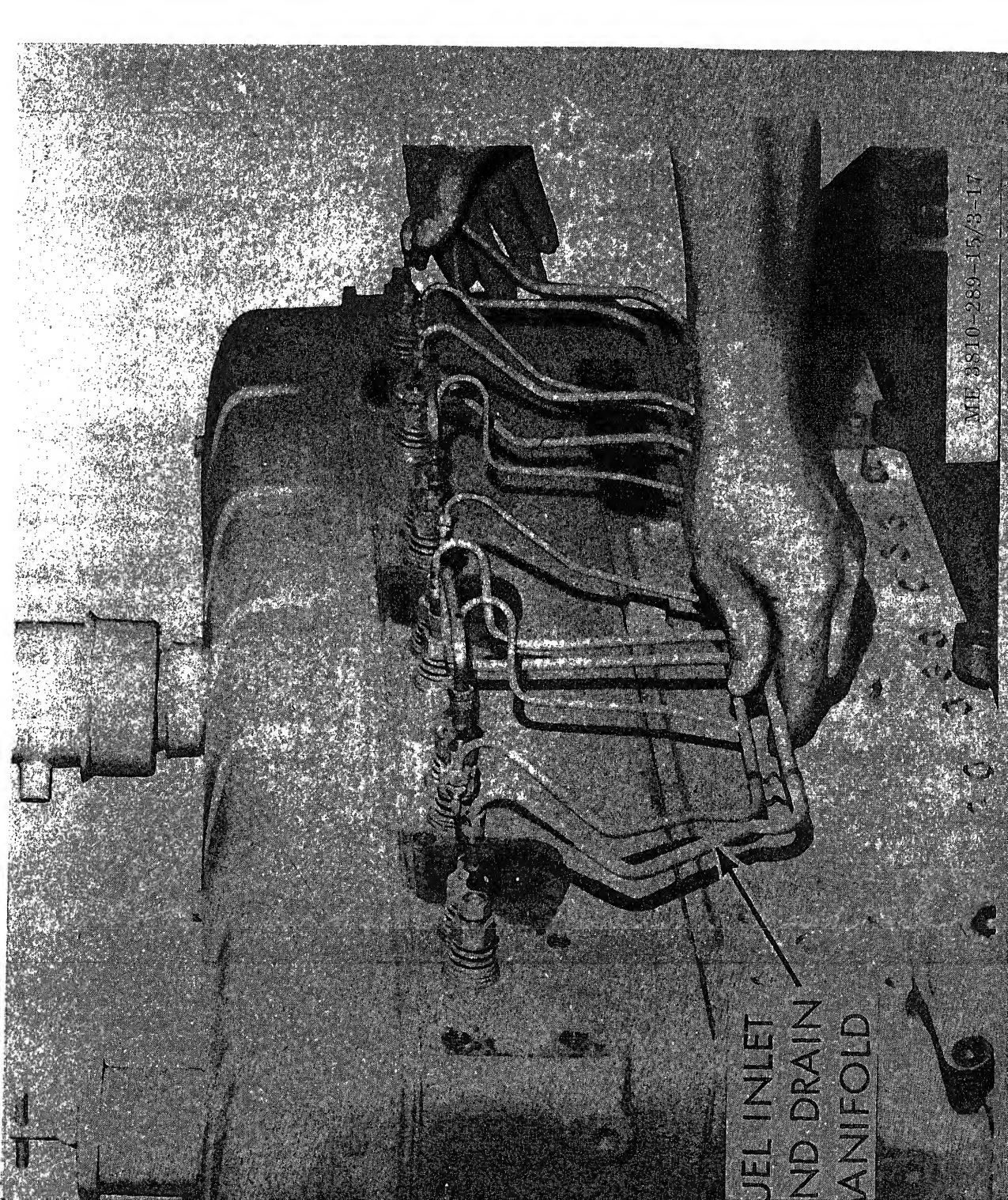
b. Tighten loose mounting bolts or fuel line connections if necessary. See that cap vent is open.

c. Refer to figure 3-7 and replace the fuel tank

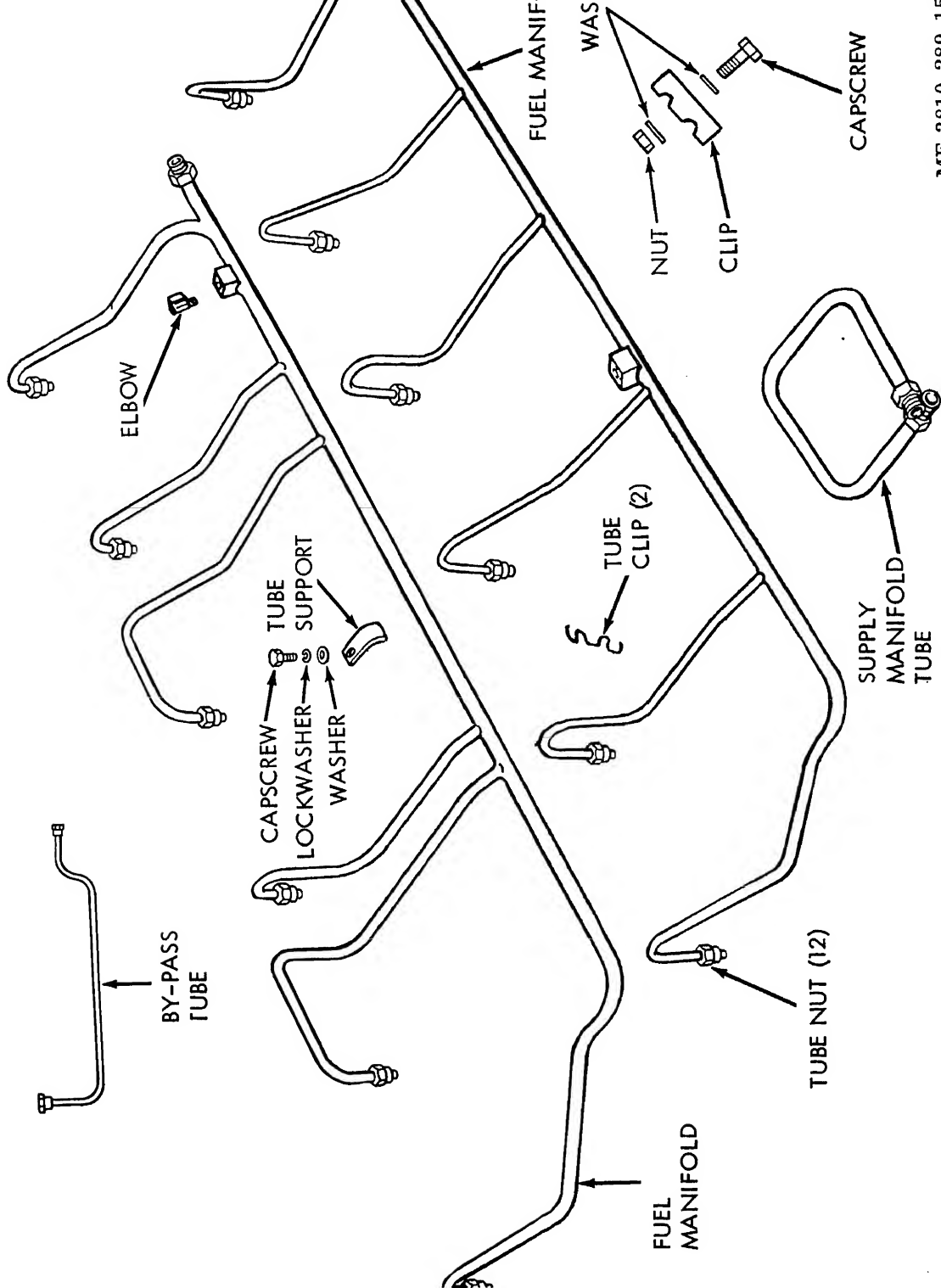


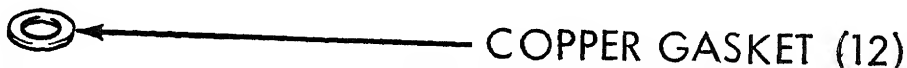
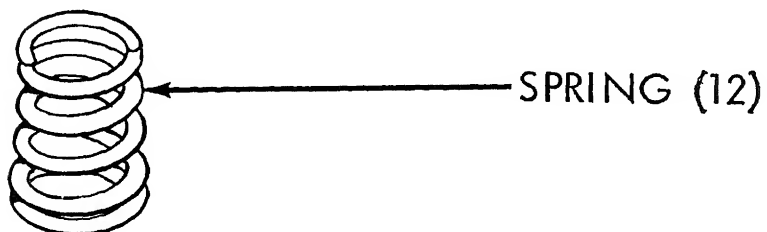
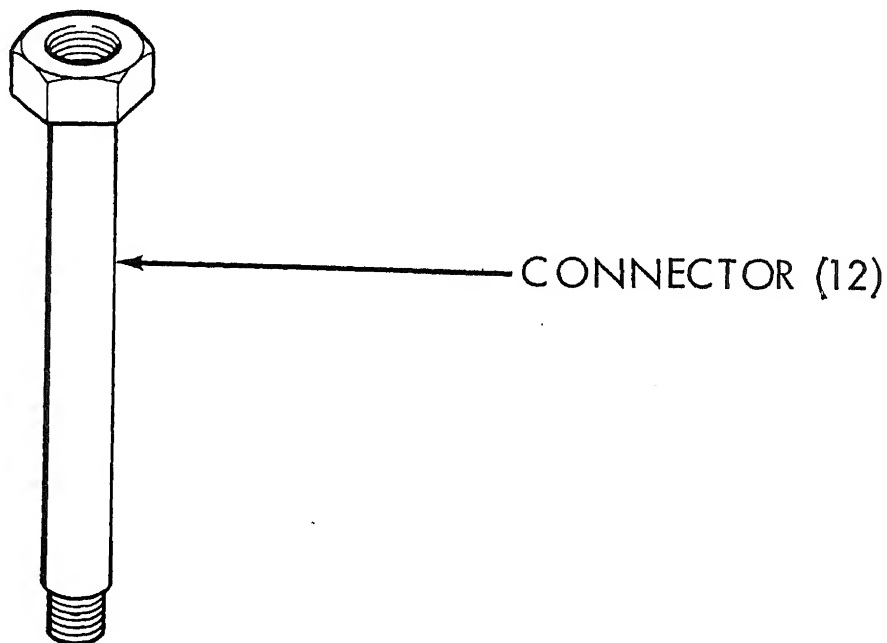
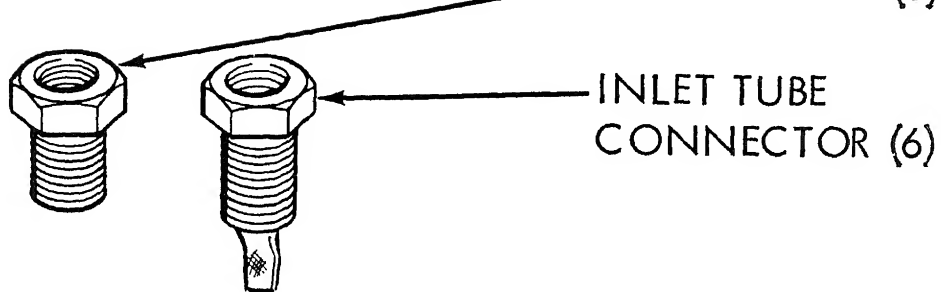
ME 3810-289-15/3-16

Figure 4-7. Fuel pump filter screen service.



FUEL INLET
AND DRAIN
MANIFOLD





SHUT-DOWN
VALVE

MOVE CAPSCREWS (2),
CLOCKWASHERS (2), AND
AT WASHERS (2)

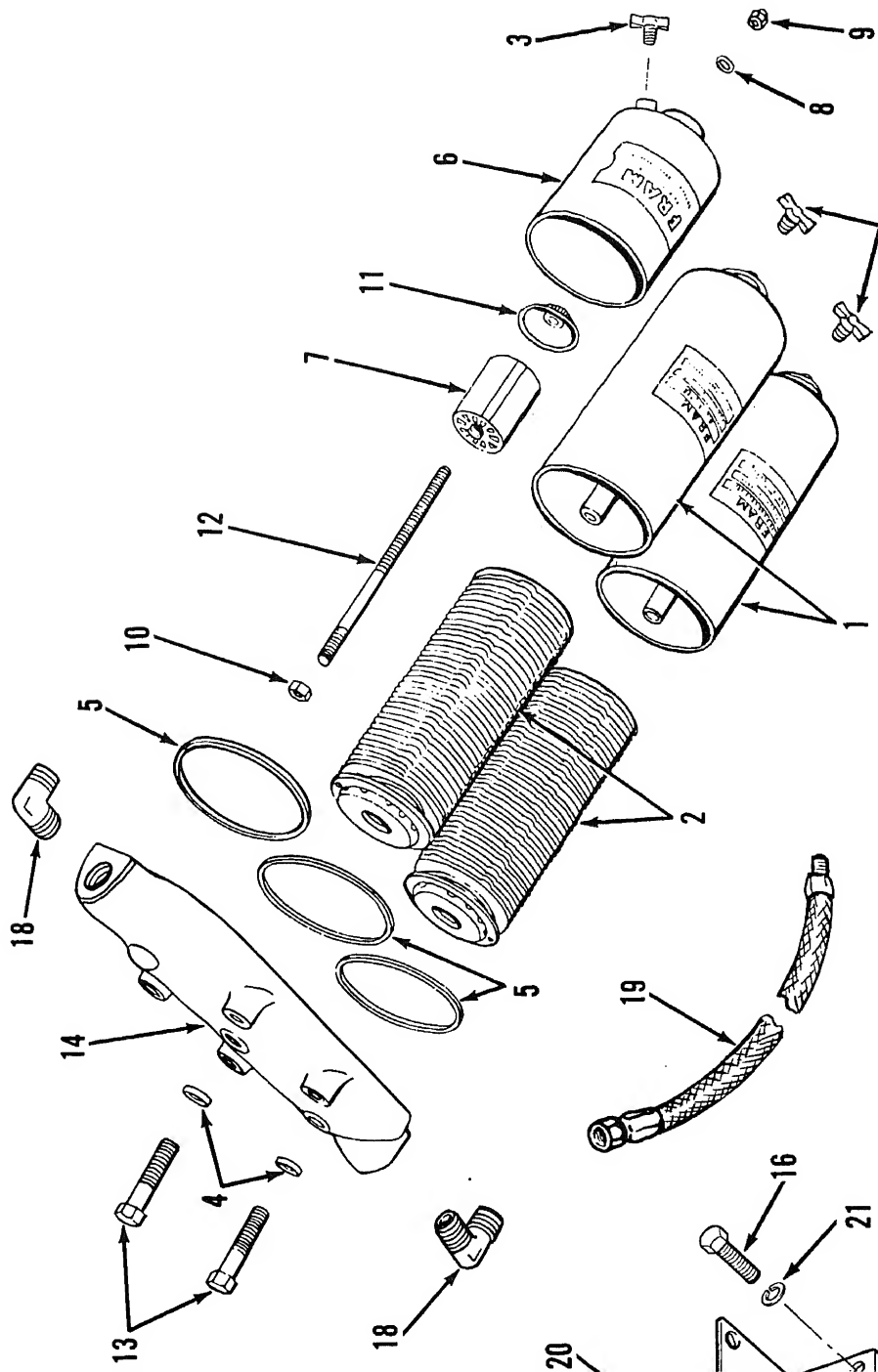
L PUMP

ME 3810-289-15/3-20

REMOVE
SCREWS (2)

MOVE SCREW
IN OUTLET CLAMP

ME 3810-289-15/3-22



FUEL FILTER REPLACEMENT

ME 3810-289-15/3-23

Filter body assembly (2)
 Filter cartridge assembly (2)
 Drain cock (2)
 Cap, cap screw (2)
 Head gasket (2)
 Filter body assembly cartridge
 trainer element

8 Washer
 9 Nut, crown
 10 Nut, hex
 11 Retainer assembly
 12 Stud
 13 Cap screw, head (2)
 14 Filter head

15 Filter mounting bracket
 16 Capscrew, bracket to block (3)
 17 Capscrew, filter to bracket (4)
 18 Filter inlet and outlet elbow
 19 Filter to pump hose
 20 Lockwasher, bracket to block (3)
 21 Lockwasher, filter to bracket (4)

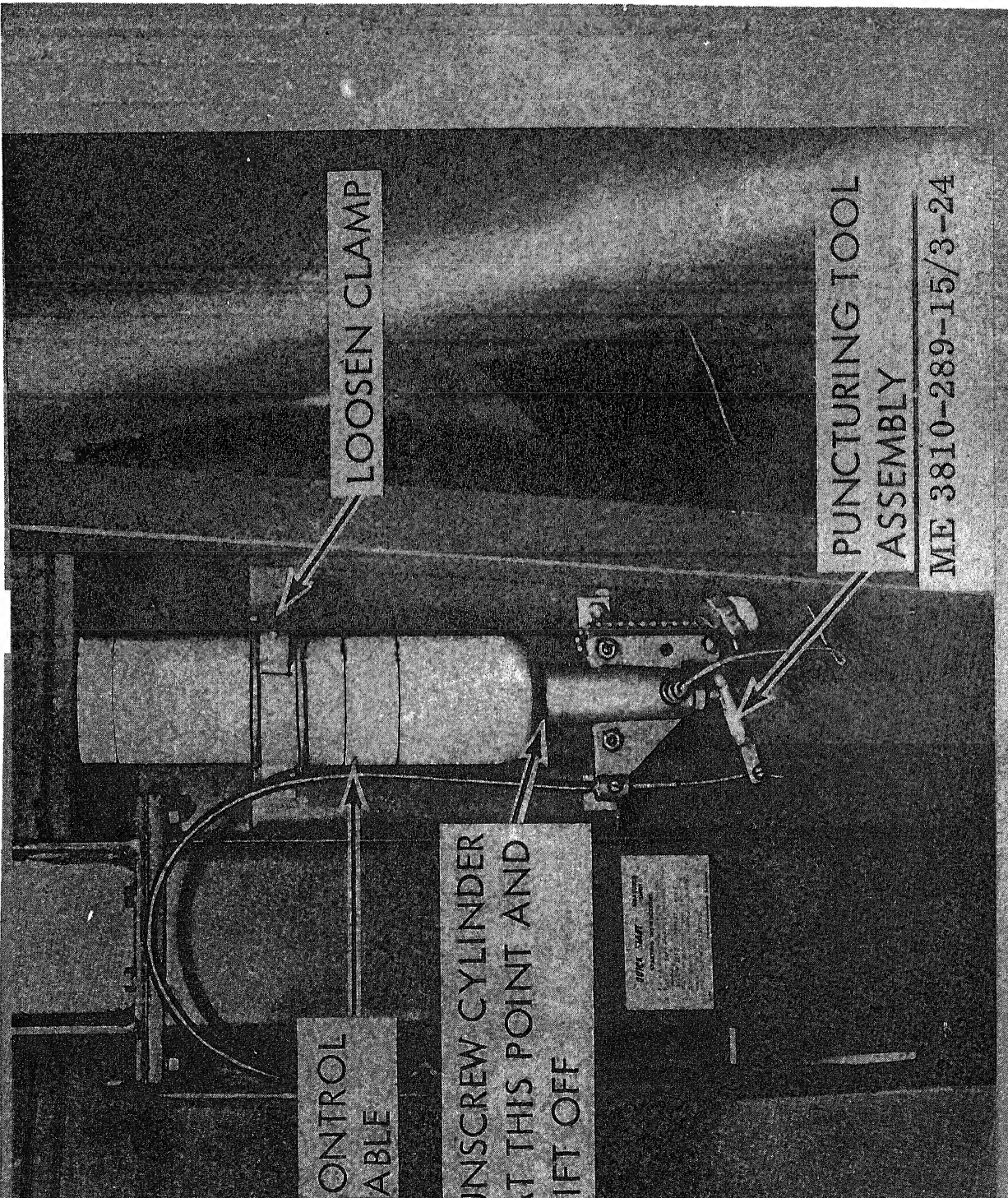
CONTROL
CABLE

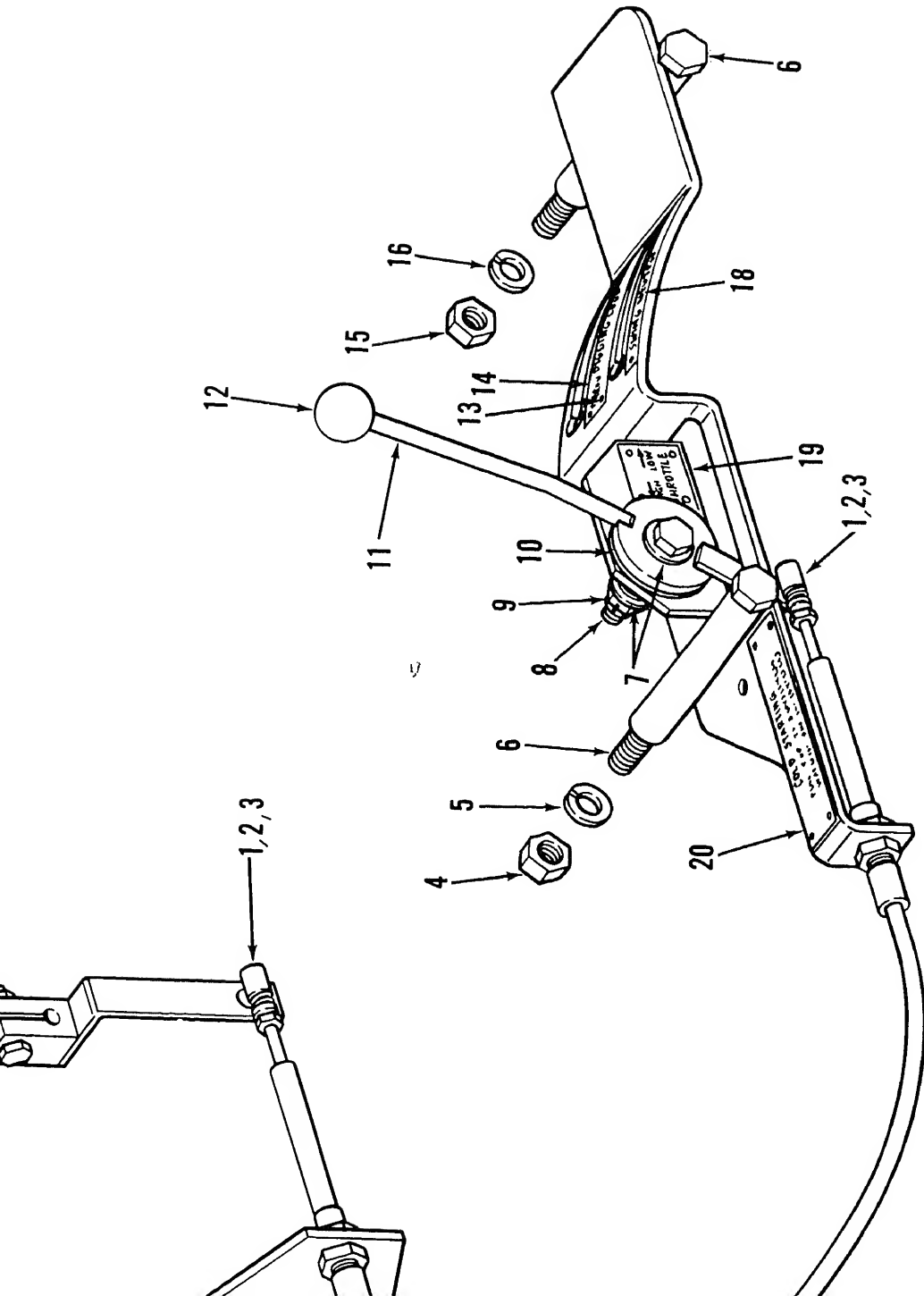
LOOSEN CLAMP

UNSCREW CYLINDER
AT THIS POINT AND
LIFT OFF

PUNCTURING TOOL
ASSEMBLY

ME 3810-289-15/3-24





- all joint
ut, hexagon
ockwasher
ut, hexagon
ockwasher
olt, hexagon
/asher, plain
- 8 Locknut
9 Spring
10 Disk
11 Arm
12 Knob
13 Screw, drive
14 Instruction plate
- 15 Nut, hexagon
16 Lockwasher
17 NOT USED
18 Instruction plate
19 Instruction plate
20 Instruction plate

Section IX. MAINTENANCE OF ENGINE EXHAUST SYSTEM COMPONENTS

4-28. Air Intake Manifold Replacement

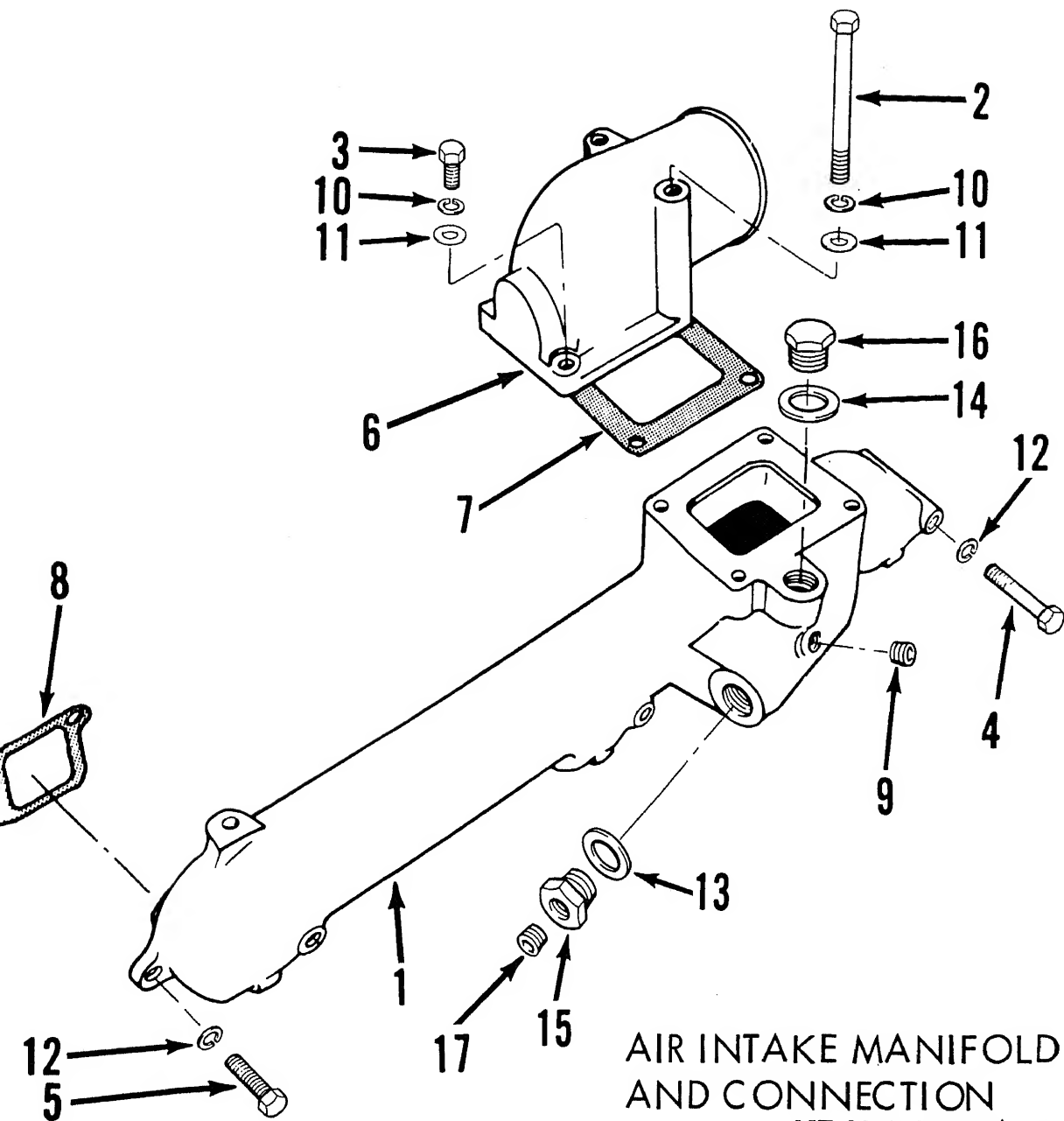
Refer to figure 4-16 and replace the air intake manifold.

4-29. Muffler and Pipes Replacement

Refer to figure 4-17 to replace the muffler and pipes.

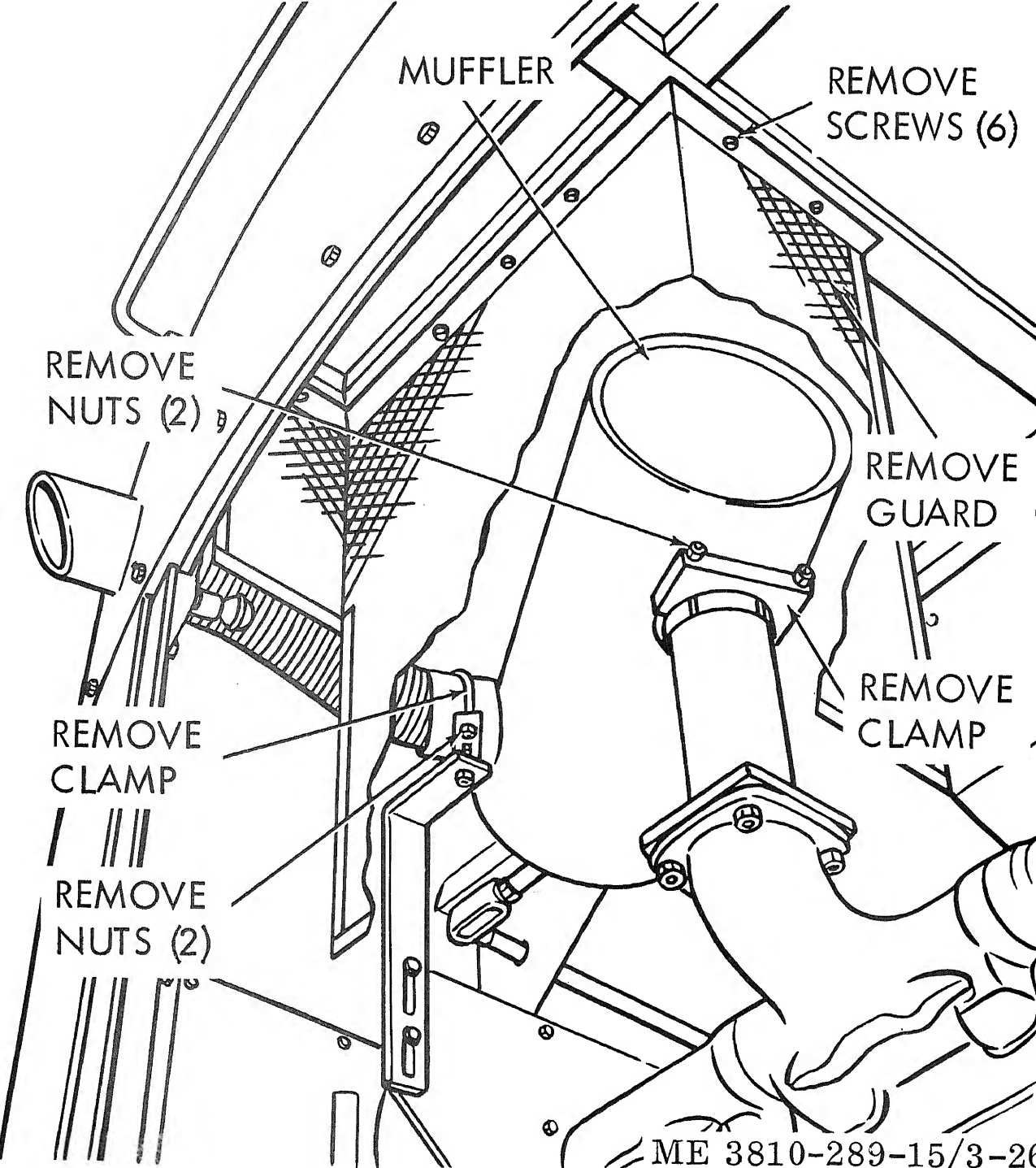
4-30. Exhaust Manifold Replacement

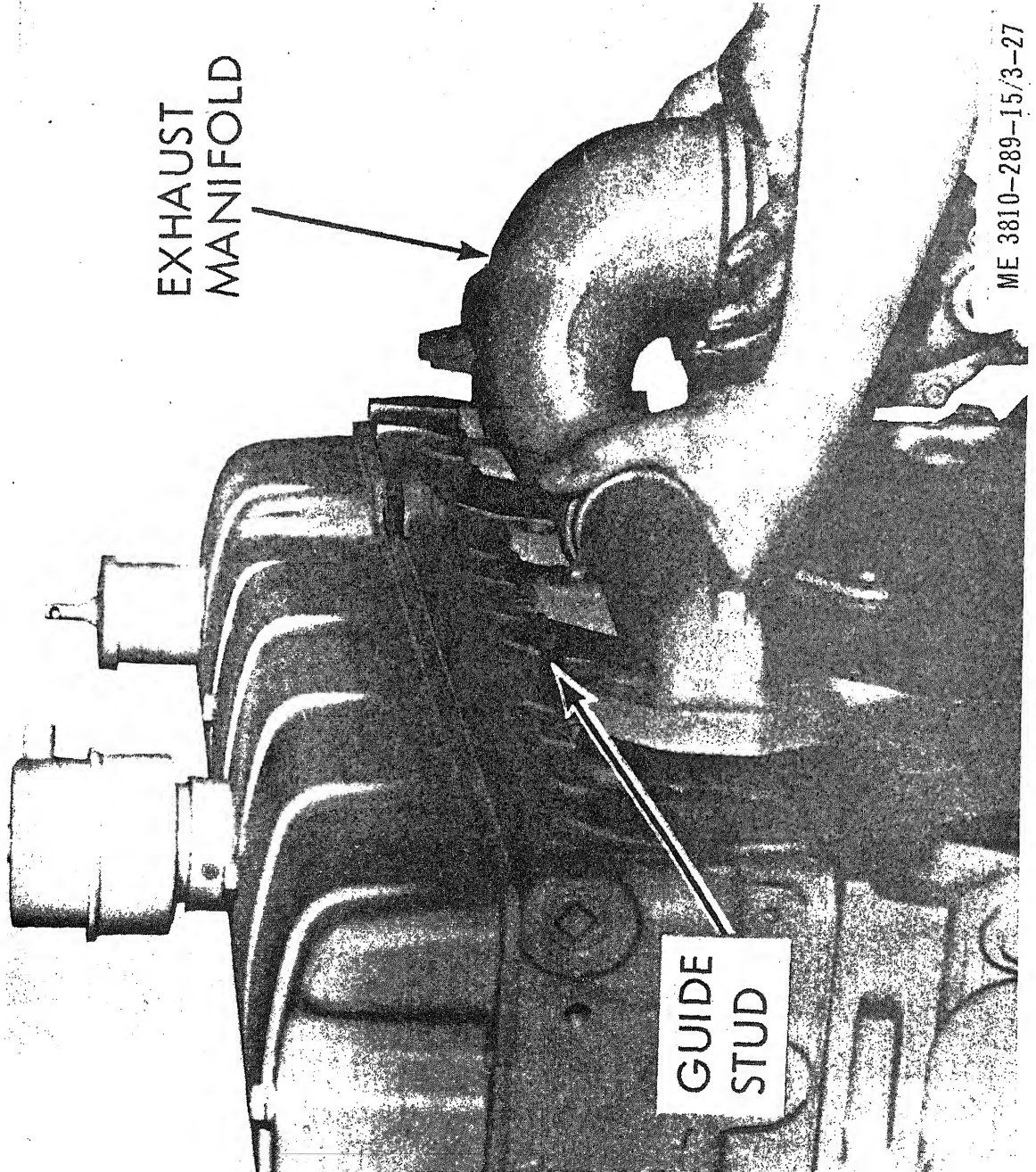
Refer to figure 4-18 to replace the exhaust manifold.



AIR INTAKE MANIFOLD AND CONNECTION

ME 3810-289-15/3-21





EXHAUST
MANIFOLD

GUIDE
STUD

ME 3810-289-15/3-27

Section X. MAINTENANCE OF ENGINE COOLING SYSTEM COMPONENTS

—31. Radiator Test and Replacement

- a. Refer to TB 750-651 and clean and test radiator.
- b. Refer to figure 4-19 and replace the radiator.
- c. Replace cracked or frayed hose and defective lamps.

—32. Fan Belt Replacement

- a. *General.* When a new belt is installed, it should be tightened until a reading of 90-to 110-lbs (pounds) force is obtained as registered on ST-968 gage. All new belts will loosen after running an hour or more and may require readjustment. Recheck belt tension with ST-968 gage; if reading is less than 80 lbs, loosen the fan bracket mounting screws. Turn the adjusting screw, as required, to obtain a reading of 90 to 110 lbs. Retighten the fan bracket mounting screws. Belt

tension should be checked every 400 to 500 hours of operation.

- b. *Replacement.* Refer to figure 4-20 and replace the fan belt.

4-33. Thermostat and Thermostatic Housing

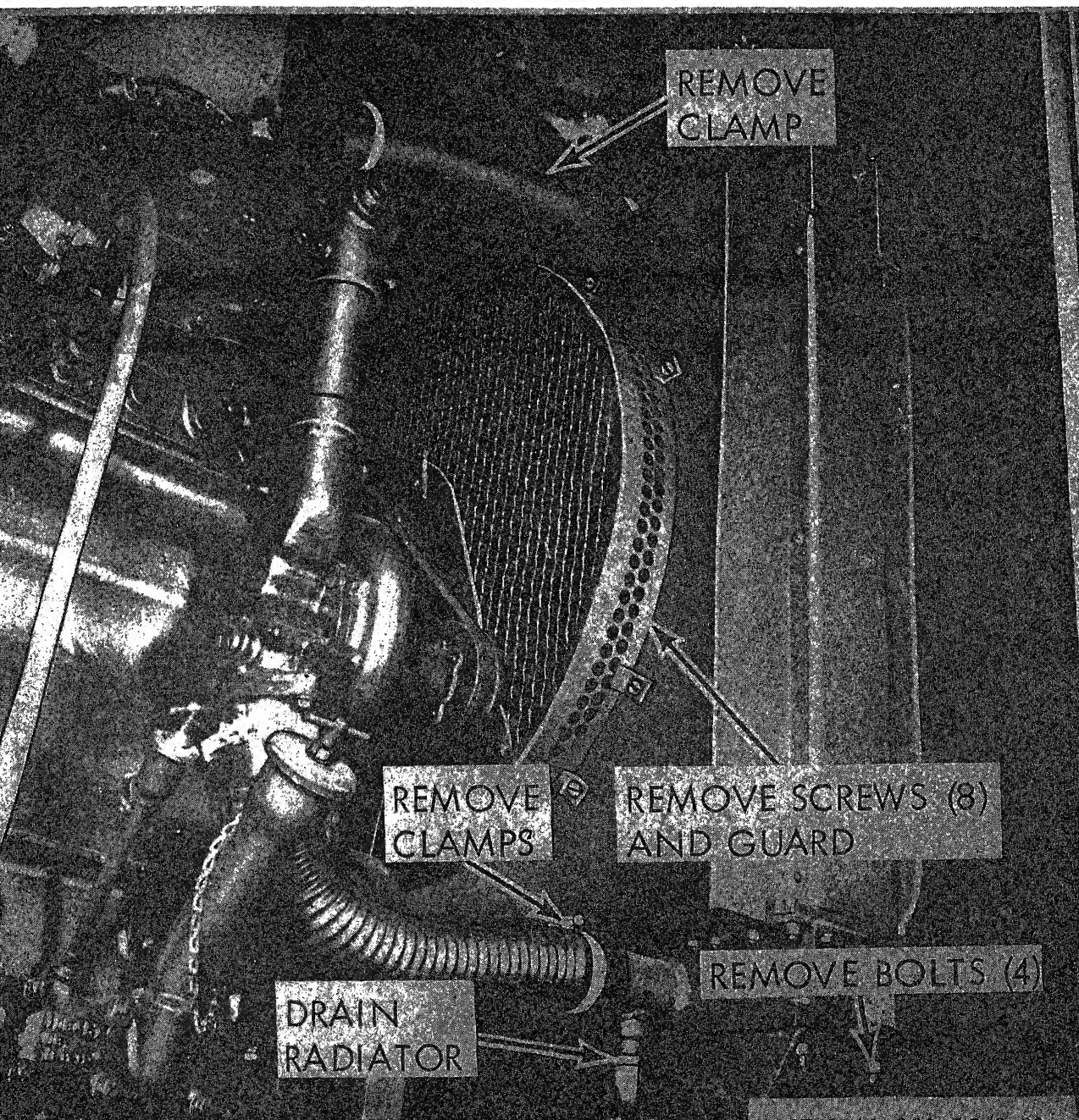
- a. *Testing.* The opening and closing of the high range (180/195° F) thermostat can be checked against a thermometer while immersed in water as the water is brought up to temperature heating. See figure 4-21.

- b. *Replacement.* Refer to figure 4-22 and replace the thermostat and thermostat housing.

4-34. Fan Blade Replacement

- a. Refer to figure 4-19 and remove the fan blade guard.

- b. Refer to figure 4-23 and replace the fan blade.



ADJUST PULLEY
UP TO TIGHTEN,
DOWN TO LOOSEN

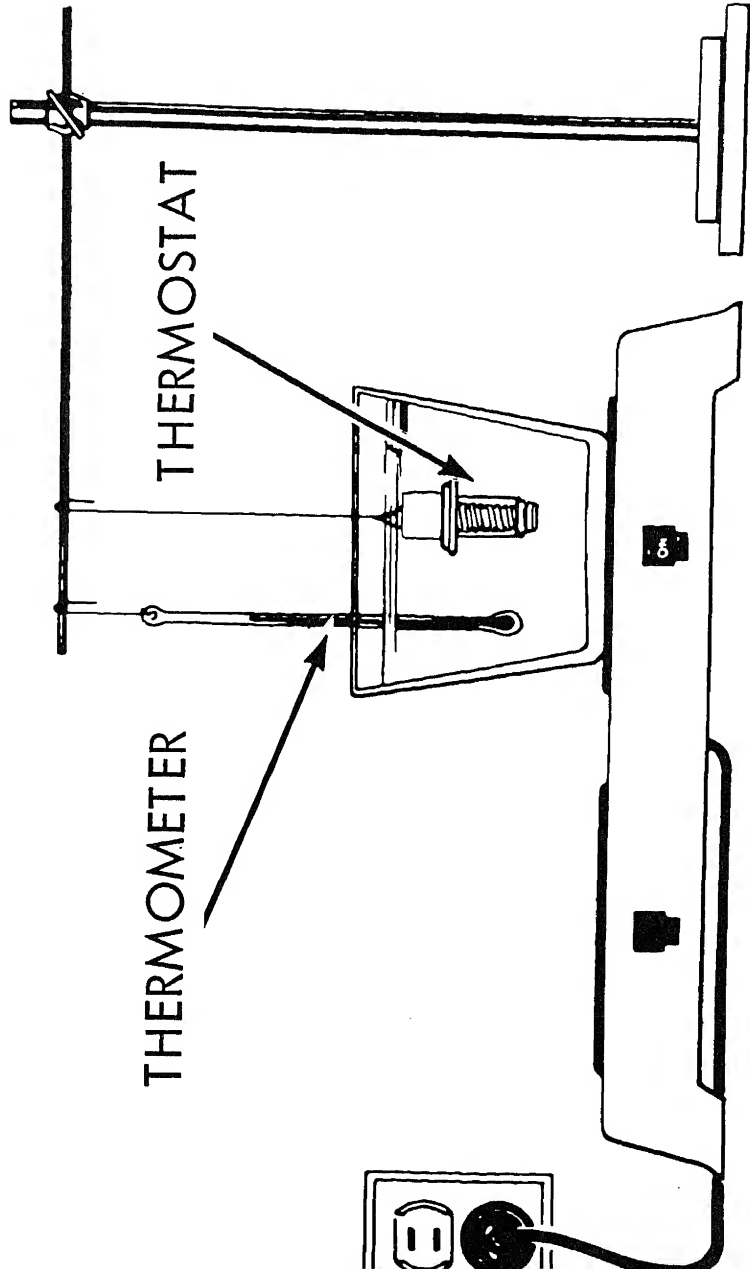


ST-968

CHECK BELT
TENSION

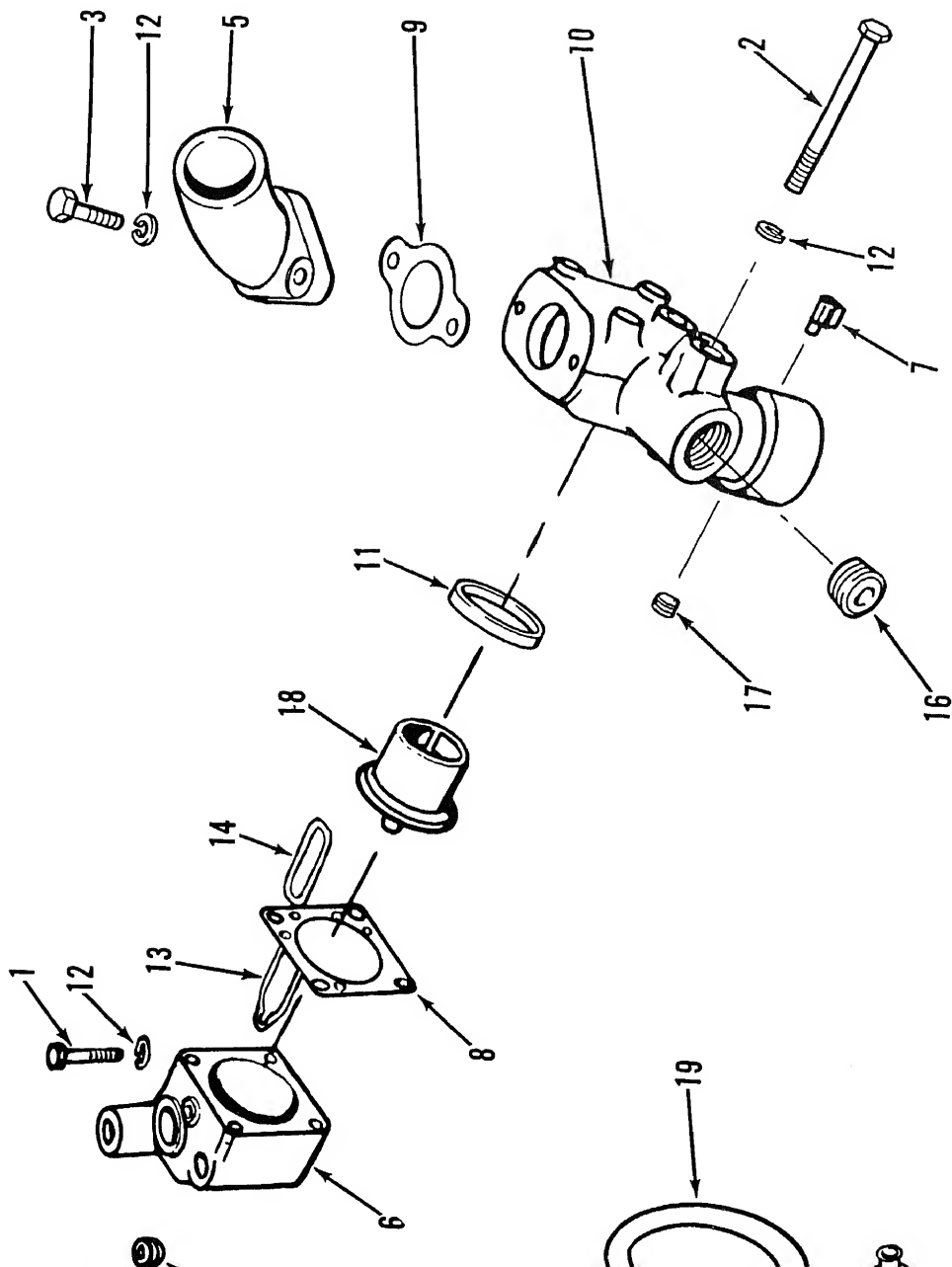
LOOSEN
CAPSCREW (4)

ME 3810-289-15/3-30



ME 3810-289-15/3-32

Figure 4-21. Thermostat testing.



ME 3810-289-15/3-33

15 Pipe (1/2") plug
 16 Pipe (1") plug
 17 Pipe (1/4") plug
 18 Thermostat (180° to 195°)
 19 Tube assembly
 20 Nut, tube (2)
 21 Tube nut (rubber) sleeve (9)

8 Gasket, thermostat housing
 9 Connection gasket
 10 Thermostat housing
 11 Seal
 12 Lockwasher (3/8") (8) Plate and insert
 13 Connection to head plate
 14 Connection to head plate

15 Pipe (1/2") plug
 16 Pipe (1") plug
 17 Pipe (1/4") plug
 18 Thermostat (180° to 195°)
 19 Tube assembly
 20 Nut, tube (2)
 21 Tube nut (rubber) sleeve (9)



REMOVE CAPSCREWS (6)
AND WASHERS (6)

—35. Alternator Assembly Service, Test, and Replacement

a. General.

(1) The self-rectifying charging alternator is designed to give long life and satisfactory service with a minimum amount of maintenance, but the following precautions must be observed.

Caution: Do not make, or break, any alternator connections while alternator is operating. This would damage the voltage regulator.

Caution: Never operate alternator without battery being connected in circuit.

Caution: When charging batteries from an external source of power, be sure battery is disconnected from circuit before beginning charging operation, to prevent damage to alternator rectifying diodes.

(2) Before removing alternator for repair or replacement, inspect the drive belt, mounting brackets, and wiring harness, in the following manner:

(a) Check belts for proper tension, excess wear, or the presence of oil or grease which could cause them to slip.

(b) Check pulleys for discoloration which could indicate overheating due to belt slippage. Inspect pulleys for wear which could allow belts to bottom in the pulley grooves. Replace worn or ineffective parts.

(c) Check mounting brackets and tension adjusting arm. Wear or looseness of these parts will prevent proper belt adjustment and may result in misalignment which will cause premature wear on belts, pulleys, and bearings. Tighten or replace parts as necessary.

(d) Inspect all wiring and terminals for signs of wear, looseness, or corrosion. Check for worn or frayed insulation which could result in shorts or grounds. Clean and tighten all terminal connections.

(2) *Negative heat sink-rectifier test* (fig. 24).

(a) The negative heat sink is grounded the housing by means of its mounting screws and stud. Be sure that these screws are clean and tight so that the negative heat sink makes good contact with the housing.

(b) Correct the negative lead of ohmmeter to check point one and touch the positive lead to terminals 4, 5, and 6. A high resistance reading should be obtained. If a low resistance reading is obtained the diode is shorted. Replace the alternator.

c. *Alternator Replacement.* Refer to figure 4-1 and replace the alternator.

d. *Alternator Belt Replacement.*

(1) Refer to figure 3-9 and replace the alternator belt.

(2) Refer to figure 4-20 and adjust alternator belt.

4-36. Reverse Current Polarity Protective Relay

a. *General.* Since alternators are sensitive to electric current polarity, incorrect wiring will cause the diodes in the alternator to short out. To protect against this, a reverse current polarity protective relay is installed in the engine electric system (fig. 1-4).

b. *Removal.*

(1) Disconnect the three cannon-plug-type electrical connections to the reverse polarity relay.

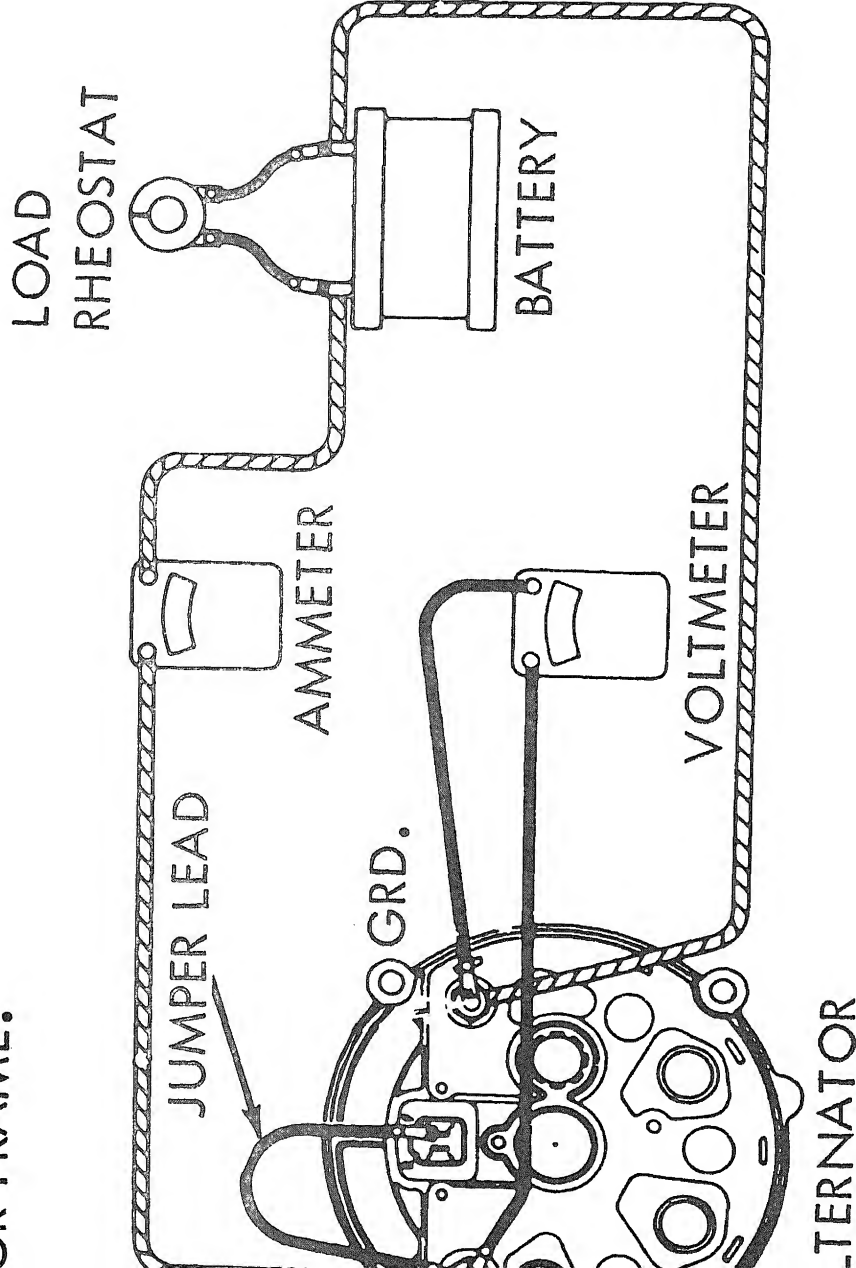
(2) Remove the two mounting capscrews and lockwashers and remove the protective relay.

c. *Installation.* Installation is reversed of removal procedures.

4-37. Starting Motor Service, Test and Replacement

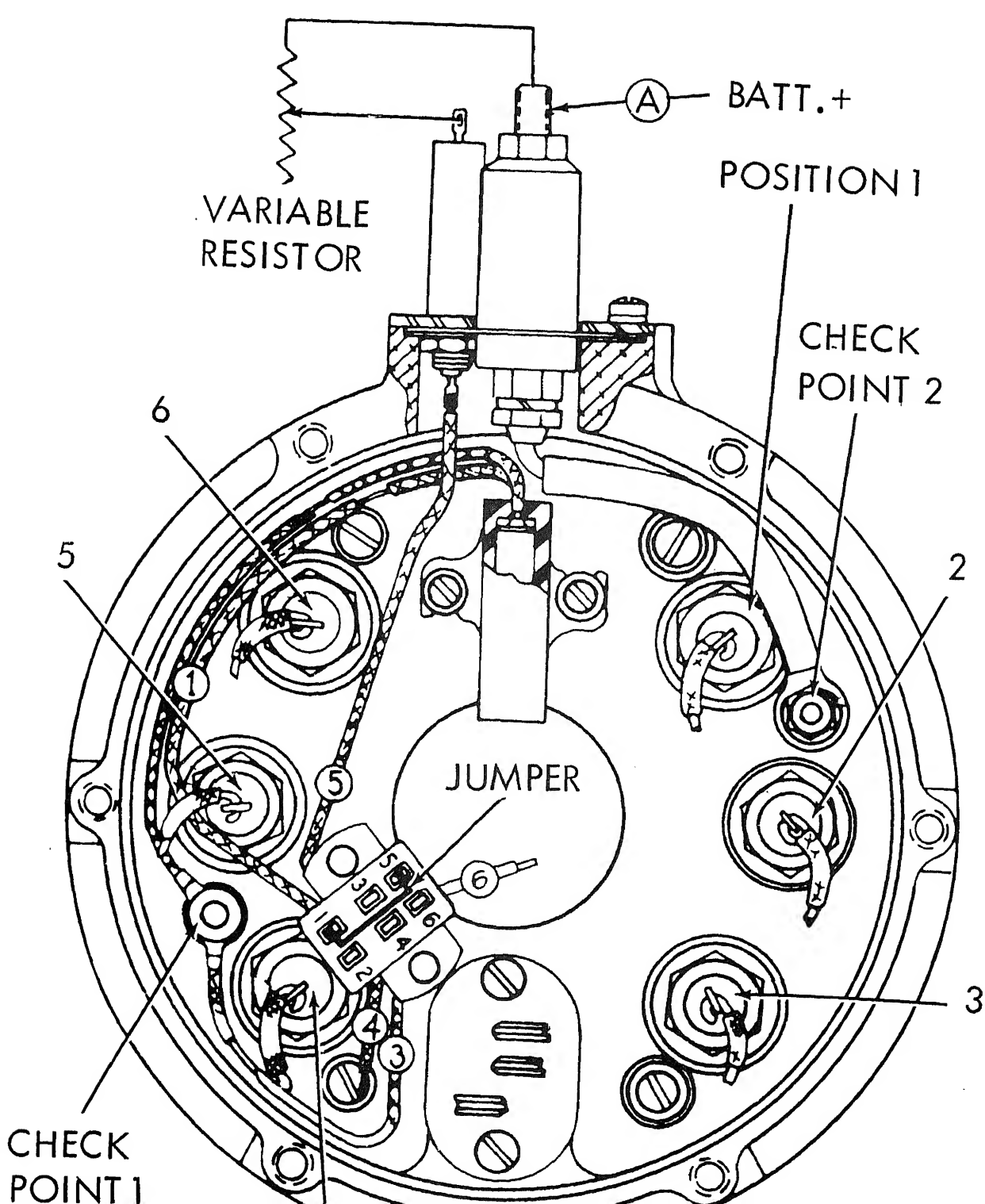
a. *Removal and Installation.* Refer to figure 4-27 to remove or install the starting motor.

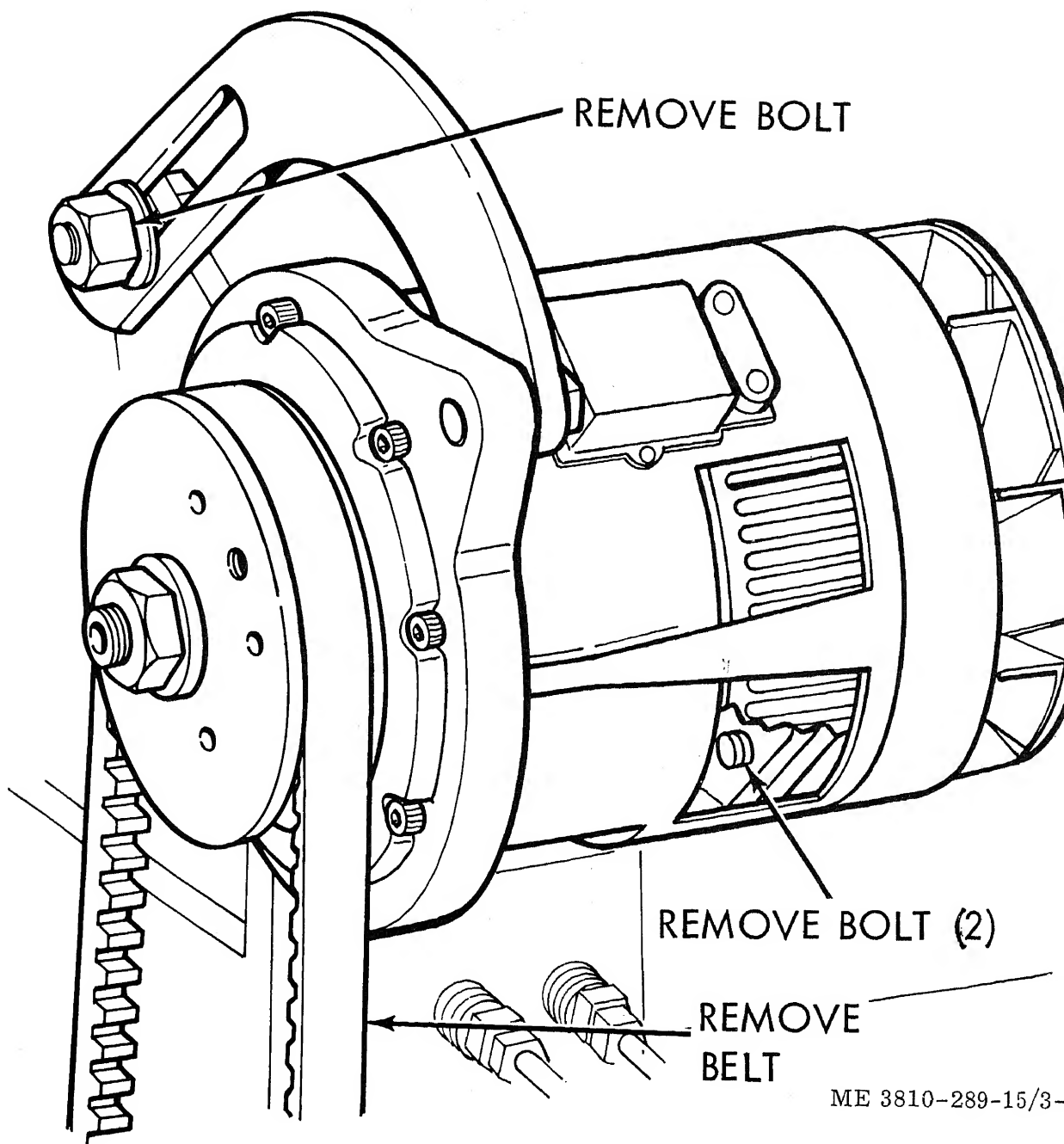
AUTION: ON NEGATIVE GROUND ALTERNATOR
CONNECT NEGATIVE BATTERY POST TO ALTERNA-
TOR FRAME.



ME 3810-289-15/3-35

Figure 4-24. Alternator test connection (sheet 1 of 2).





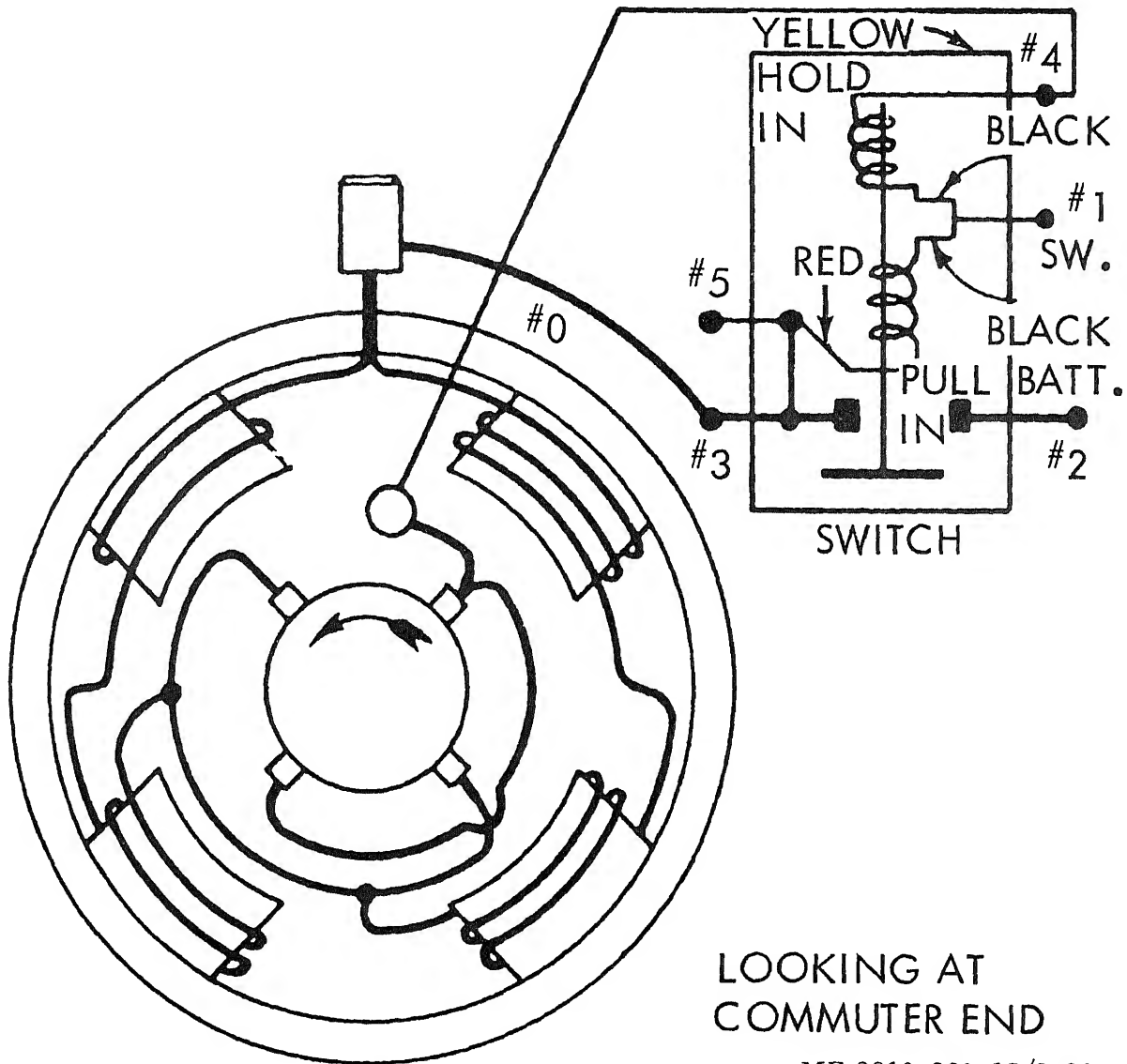


Figure 4-26. Starting motor, internal wiring diagram.

with gasoline or kerosene to remove any gummy deposit; then, apply a thin film of light graphite grease so the pinion will move freely.

Note. Do not use excessive oil or heavy oil or grease.

c. Test.

(1) *Field coil.* Make test only after coils have been dried if they have been cleaned. With test lamp prods, one held on the field ring and the other on the field terminal, determine that the windings are not grounded to field ring or pole pieces. If coils are shorted or grounded, remove and inspect if they can be reinsulated to eliminate the trouble. Replace coils if short or ground cannot be eliminated. Refer to internal wiring diagram (fig. 4-26).

(2) *Armature.*

(a) Check the armature for grounds with 110-volt test light by touching one probe to a commutator bar riser and the other to the armature core. Test all commutator bars in this manner. If test light glows, the armature is grounded and must be replaced.

(b) Check armature for short circuits with a growler. Place the armature in the growler,

against the armature core, and cause the strips to vibrate. If a short circuit is found, the armature must be replaced.

(3) *Load test.*

(a) Connect the starting motor in series with a 12-volt, fully charged battery (a minimum specific gravity of 1.250) and an ammeter.

(b) The starting motor, turning clockwise from the drive end, should draw between 85-90 amps at 3800 rpm.

4-38. Solenoid Test and Replacement

a. Removal and Installation. Refer to figures 4-29 to remove or install the solenoid.

b. Test.

(1) After reassembly of the motor, the switch solenoid is installed on the field ring and the timing checked for proper travel of the drive pinion on the armature shaft.

(2) The shaft lever is inserted through the switch cover seal. Make certain the nylock insert is in position in the threaded shaft, and that the shaft is aligned with the threaded hole in the plunger.

REMOVE
BOLTS (2)

DISCONNECT
ELECTRICAL
LEADS

PUSH

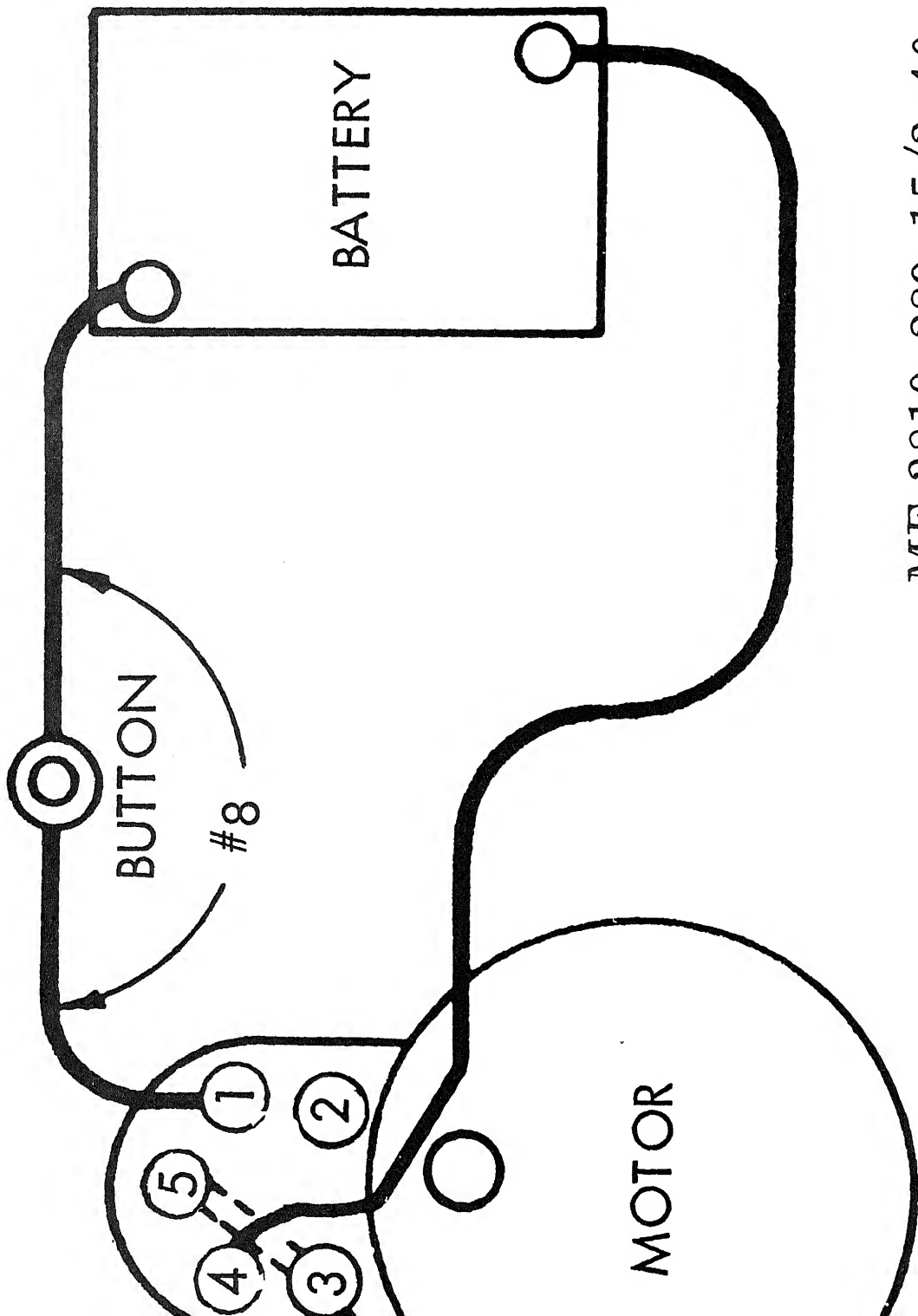
BUTTON

#8

BATTERY

MOTOR

ME 3810-289-15/3-40



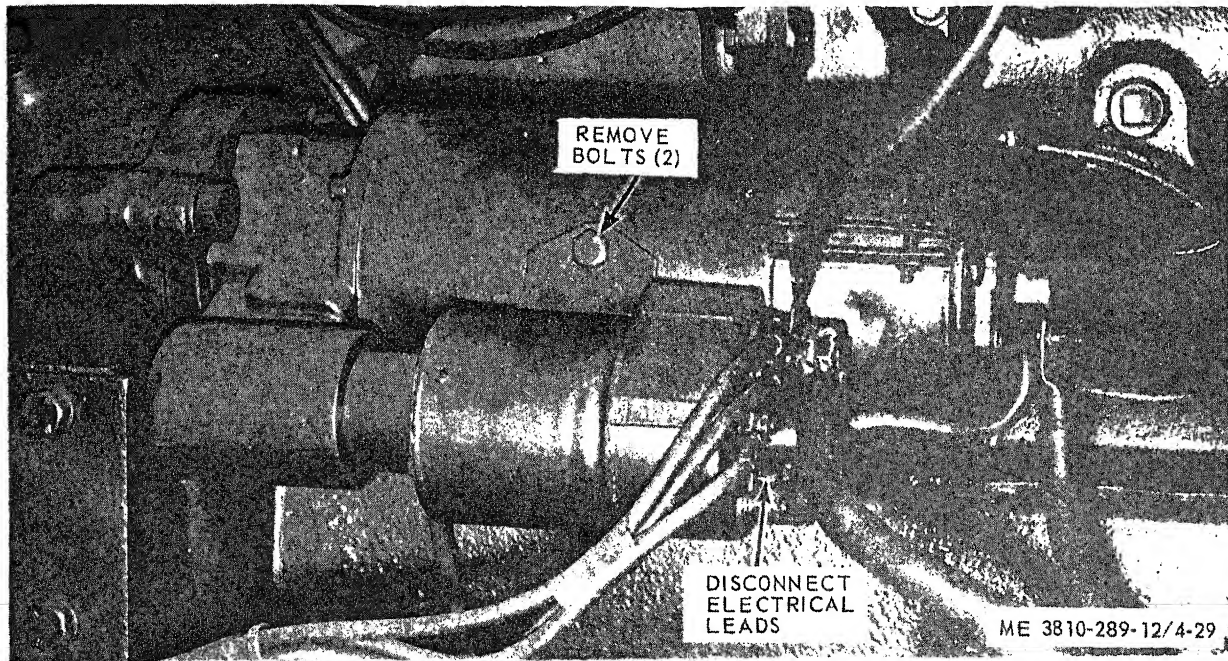


Figure 4-29. Solenoid replacement.

(3) Insert the switch shaft adjusting tool through the access hole in the switch terminal housing, and turn the shaft clockwise until it bottoms. Back off counterclockwise approximately five turns and push the switch forward into the shaft housing. Aline the mounting holes in the switch with the ones in the field ring and install two mounting screws.

(4) Connect a 12-volt battery to the switch terminals, numbers 1 and 4 (fig. 4-28). With the solenoid switch energized, gently push the drive assembly back against the shift arm cams and check the spacing between the face of the pinion and thrust washer, using a 0.187 inch thick gage. The final adjustment is accomplished by turning the adjusting tool clockwise or counterclockwise until the 0.187-inch gage just fits between the pinion and thrust washer.

Note. This adjustment must be made with the solenoid switch deenergized.

(5) Replace the pipe plug in the switch terminal housing and seal with gasket sealer.

adjusted to react within a pressure range of 10 to 70 psi, in increments of ten, and a temperature range of 170–210 degrees, in increments of twenty. The engine safety control is not serviceable. Failure to operate properly requires replacement of the entire unit.

b. Removal. Refer to figure 4-30 and remove the engine safety control.

c. Installation. Follow the reverse procedure for removal.

4-40. Switches, Gages, Meters Replacement

Refer to figure 4-31 and replace the switches, gages and meters on the engine control panel.

4-41. Lamp Replacement

Refer to figure 4-31 and replace the lamps and fuses.

4-42. Wiring Harness Repair

Refer to figure 4-31 and repair wiring harness.

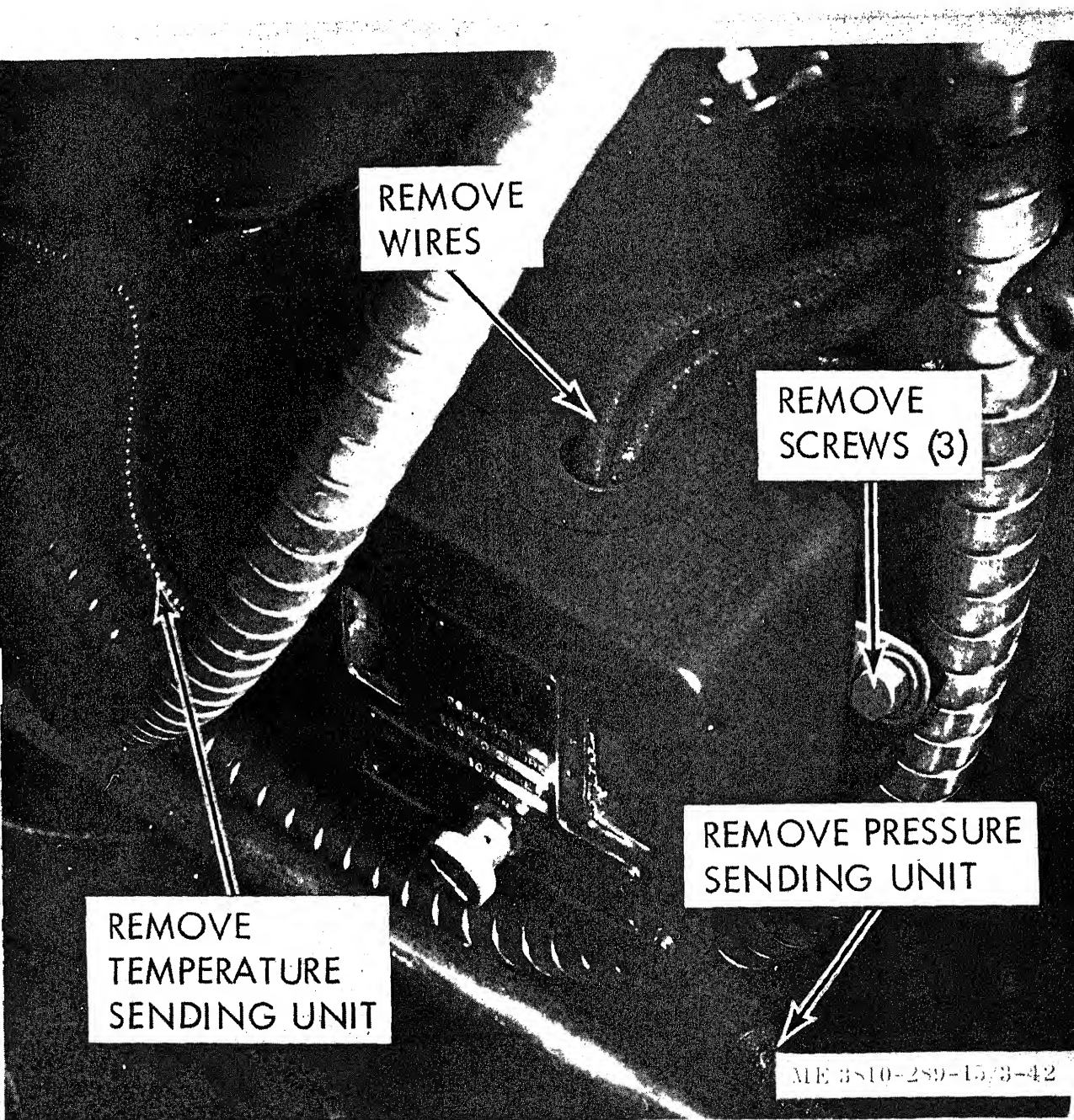
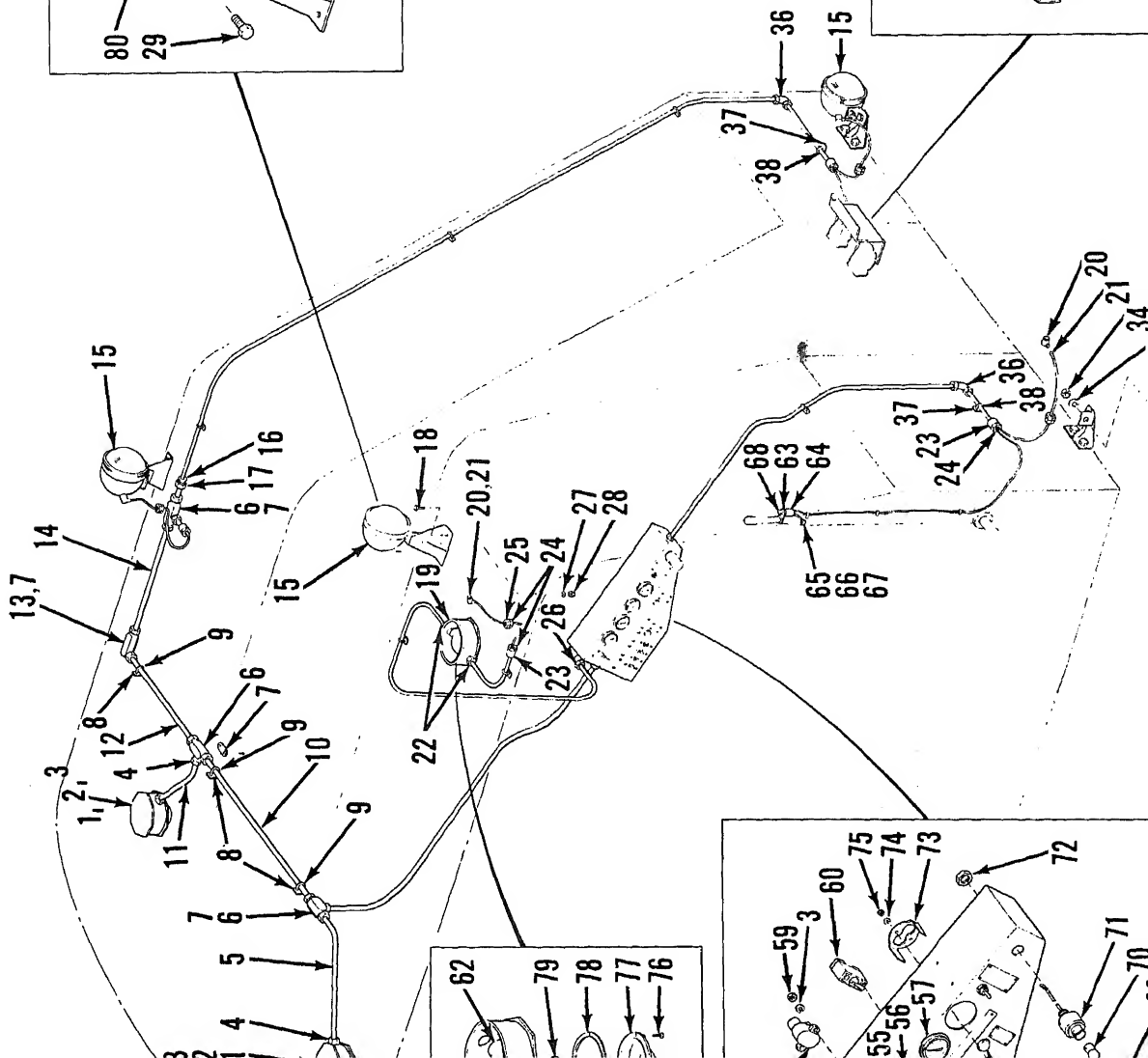
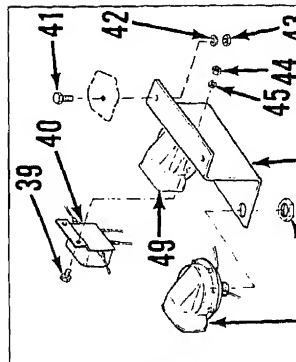
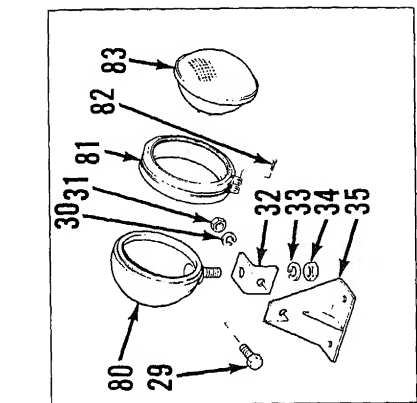


Figure 4-30. Engine safety control replacement.



Conduit $\frac{3}{4}$ "	33 Washer, spring lock $\frac{3}{8}$ "	61 Light, warning
Box $\frac{3}{4}$ "	34 Nut, full $\frac{5}{8}$ "	62 Socket, lamp
Cover	35 Support	63 Bracket
Bracket	36 Elbow $\frac{1}{2}$ "	64 Switch
V-bolt	37 Bracket	65 Terminal
Conduit $\frac{3}{4}$ "	38 V-bolt	66 Screw #10 x $\frac{1}{2}$ "
Conduit $\frac{3}{4}$ "	39 Screw, cap $\frac{1}{4}$ " x $\frac{3}{4}$ "	67 Washer, spring lock #10
Conduit $\frac{3}{4}$ "	40 Relay	68 Button, horn
Box $\frac{3}{4}$ "	41 Screw, cap $\frac{3}{8}$ " x 1"	69 Shield
Conduit $\frac{3}{4}$ "	42 Washer, spring lock $\frac{3}{8}$ "	70 Lamp
Floodlamp	43 Nut, full $\frac{3}{8}$ "	71 Socket, lamp
Reducer $\frac{3}{4}$ "— $\frac{1}{2}$ "	44 Nut, full $\frac{1}{4}$ "	72 Nut
Conduit $\frac{3}{4}$ "	45 Washer, spring lock $\frac{1}{4}$ "	73 Clamp
Screw, cap $\frac{3}{8}$ " x 1 $\frac{1}{4}$ "	46 Bracket	74 Washer, spring lock
Dome light box	47 Nut	75 Nut
Nipple, terminal	48 Horn	76 Screw, cap
Tongue, terminal ring	49 Horn	77 Lens
Connector $\frac{1}{2}$ "	50 Gauge, oil pressure	78 Gasket
Coupling, pipe $\frac{1}{2}$ "	51 Screw #8-32 x $\frac{1}{2}$ "	79 Lamp
Nipple, chase $\frac{1}{2}$ "	52 Panel, instrument	80 Body assembly
Locknut, conduit $\frac{1}{2}$ "	53 Screw #10-24 x $\frac{3}{4}$ "	81 Ring
Elbow $\frac{1}{2}$ "	54 Lamp, panel	82 Screw, cap
Washer, spring lock $\frac{3}{8}$ "	55 Gauge, battery indicator	83 Sealed beam unit
Nut, full $\frac{3}{8}$ "	56 Gauge, fuel	

Figure 4-31. Horns, lights and control panel.

—46. Battery and Battery Cables

a. Inspection. If the battery requires frequent addition of water and is gassing excessively, test it. If in good condition, it is undoubtedly due to overcharging. If one or more cells continually require more water than others, it is an indication of a damaged cell which should be checked by the maintenance repair.

b. Service.

(1) Do not allow the surface of the electrolyte to get below the top of the separators. Use only clean, distilled water to keep the battery filled. Do not fill higher than just below the bottom of the filling tube, for "gassing" will cause the electrolyte to spill over. Never add acid to the battery, as this will give a false reading as to the condition of the battery.

(2) Keep the terminals tight and clean. If they show a tendency to corrode, clean and apply a thin coat of vaseline to protect them from the acid. Keep the outside of the battery clean. Neutralize any electrolyte that may be on the metal surfaces with a cloth saturated with ammonia or bicarbonate of soda solution (one pound of baking soda to one gallon of water), then wash off with

(3) Clean vent hole in filler caps before stalling.

(4) Replace a cracked or leaking battery.

c. Test. Test the specific gravity of each with a hydrometer. A reading of 1.270 to 1.300 indicates fully charged; 1.230, half charged; and 1.150, dead. Never take a reading just after adding water for the reading will not be true.

Caution: Do not allow battery to stand in the discharged state. It will become ruined by sulphation.

Note. It is especially important in cold weather to test the specific gravity. A battery freezes between the temperatures 20 degrees above zero and 50 degrees below zero, depending on the state of its charge. Do not add water after shutting down for the night, or it will freeze quickly; see that it gets a charge after adding water.

d. Replace. Refer to figure 4-32 to replace batteries or battery cables.

Caution: Always disconnect the negative cable first when removing batteries and connect the positive cable last when installing batteries.

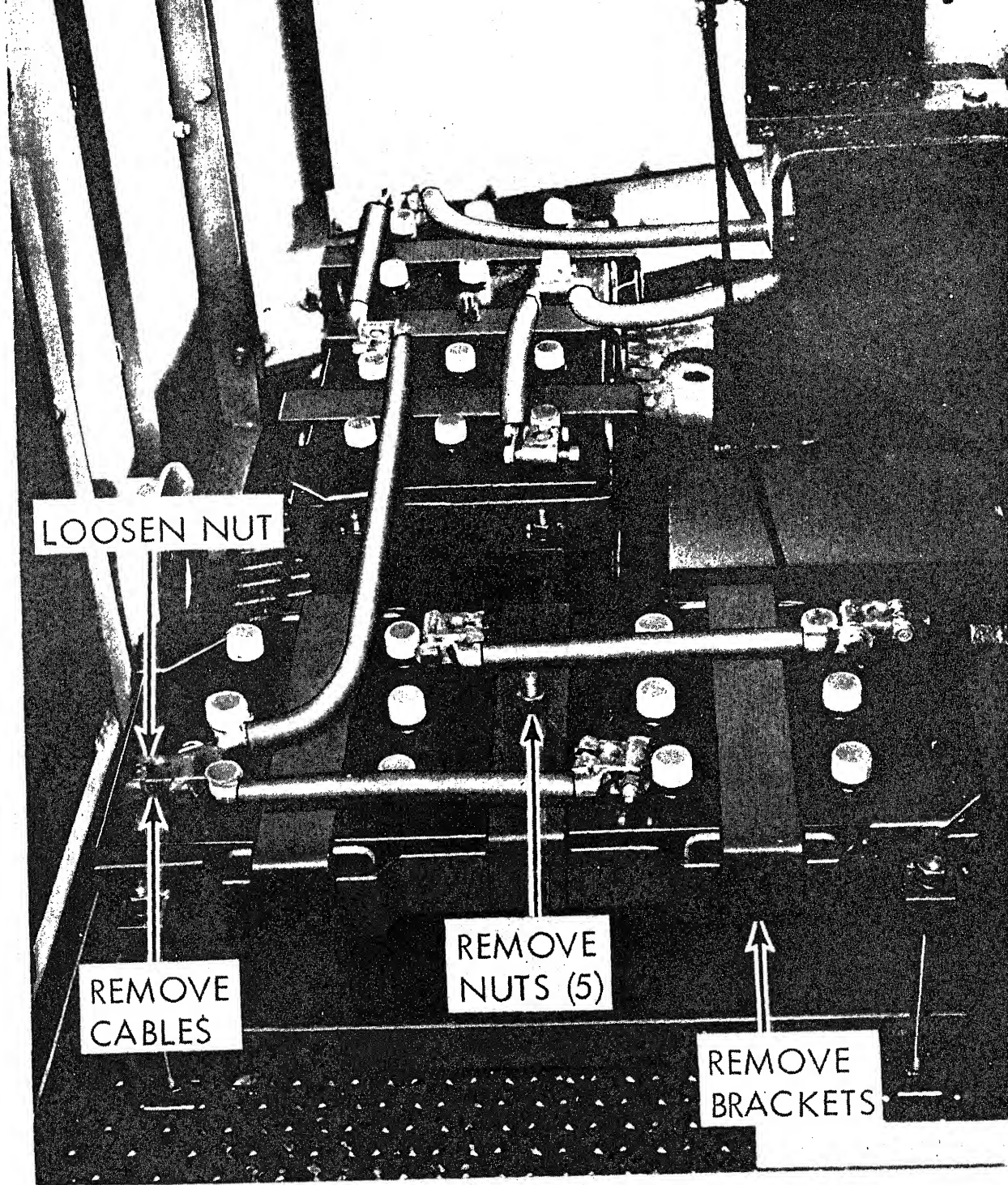


Figure 4-32. Battery and battery cable replacement.

Section XII. MAINTENANCE OF TRANSMISSION ASSEMBLY WHEELS AND TRACK COMPONENTS

47. Transmission Assembly Inspection and Service

Inspect the gears for damage and wear. Lubricate the shaft in accordance with the current lubrication order. See figure 4-33.

48. Track Support Rollers and Brackets, Replacement and Repair

a. General. Check rollers for flat spots, cracks, or other damage. Flat spots or cracks in rollers can be built up by welding. Repair dust shields by welding.

b. Replacement of Upper Support Rollers. The upper idler rollers (fig. 4-34) which support the top of the tread belt can be removed without disconnecting the belt, as follows:

(1) With machine on firm level ground, travel it forward for a distance equal to length of machine so that all slack in belt is at the top.

(2) Pry up track near roller for clearance and insert blocking to hold tread belt clear of roller.

(3) Remove blank bolt. Withdraw roller shaft and remove roller.

(4) Installation is the reverse process of the removal steps.

c. Replacement of Lower Support Rollers. Any one or all of the lower idler rollers (fig. 4-35) on the side frame may be removed without taking the tread belt apart by proceeding as follows:

(1) Propel onto a block of wood so block is under tumbler nearest roller to be removed. This should allow enough sag of treads to clear roller. Do not, release takeup tumbler adjustment.

(2) Remove the two lower U-bolts which will allow roller shaft assembly to drop down.

(3) Installation is the reverse process of the removal steps.

49. Track Roller Chain Adjustment,

(3) Turn the adjusting nuts until there is 3-or 4-inches slack on the lower side of the chain with the top being tight.

(4) Be sure to turn both nuts of a pair the same amount (fig. 3-12) so as to keep the chain sprockets in correct alignment. When correct adjustment is obtained, replace the adjusting nuts, tighten the bearing bolts, and tighten the lock nuts.

(5) Readjust the crawler track belts to correct tension as described in paragraph 3-22.

b. Replace.

(1) Remove propelling chain adjusting lock nuts and turn adjusting nuts as far as possible to slack off roller chain adjustment.

(2) Select a pin link in mesh with one of the sprockets and remove cotter pin from that link and drive out.

(3) Slide pin fully out to separate chain links and remove chain from sprockets. Insert cotter pin in chain pin to prevent loss.

(4) To install roller chain, follow the removal steps in reverse order.

c. Repair. To repair a defective link, follow the instructions for removing the propelling chain and remove the defective link only.

4-50. Track Assembly Repair

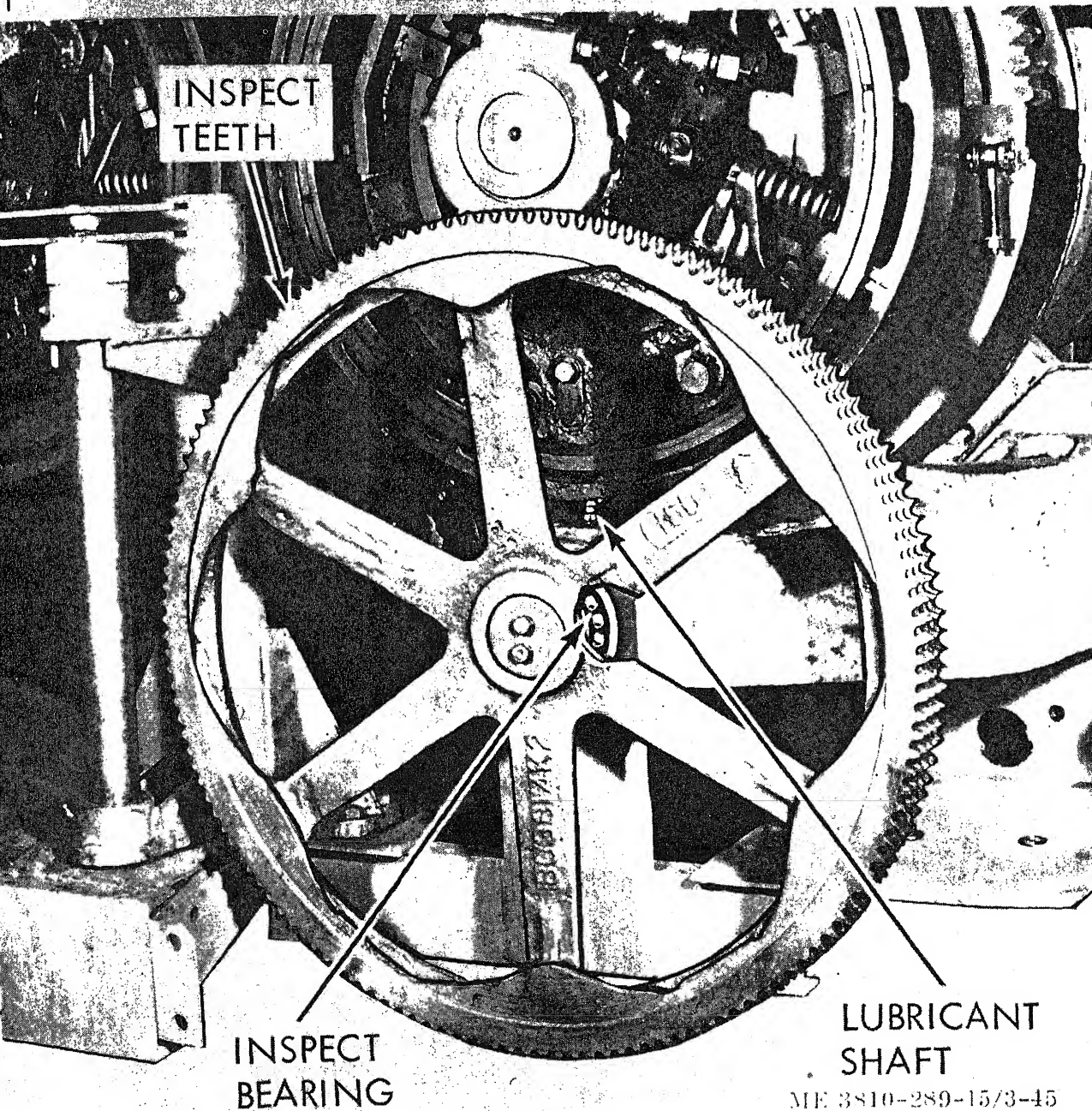
a. Loosen clamping bolts on tumbler shaft.

b. Loosen the nuts on the track adjusting screws at the takeup tumbler end by equal amounts.

c. Propel machine so that the damaged link is in a position corresponding to ten o'clock on the driving tumbler.

d. Secure the link below the faulty one to the driving tumbler by means of a rope and put a chock under the belt.

e. Remove the keeper pins securing the track link pins. If necessary, get a purchase on the



WOOD

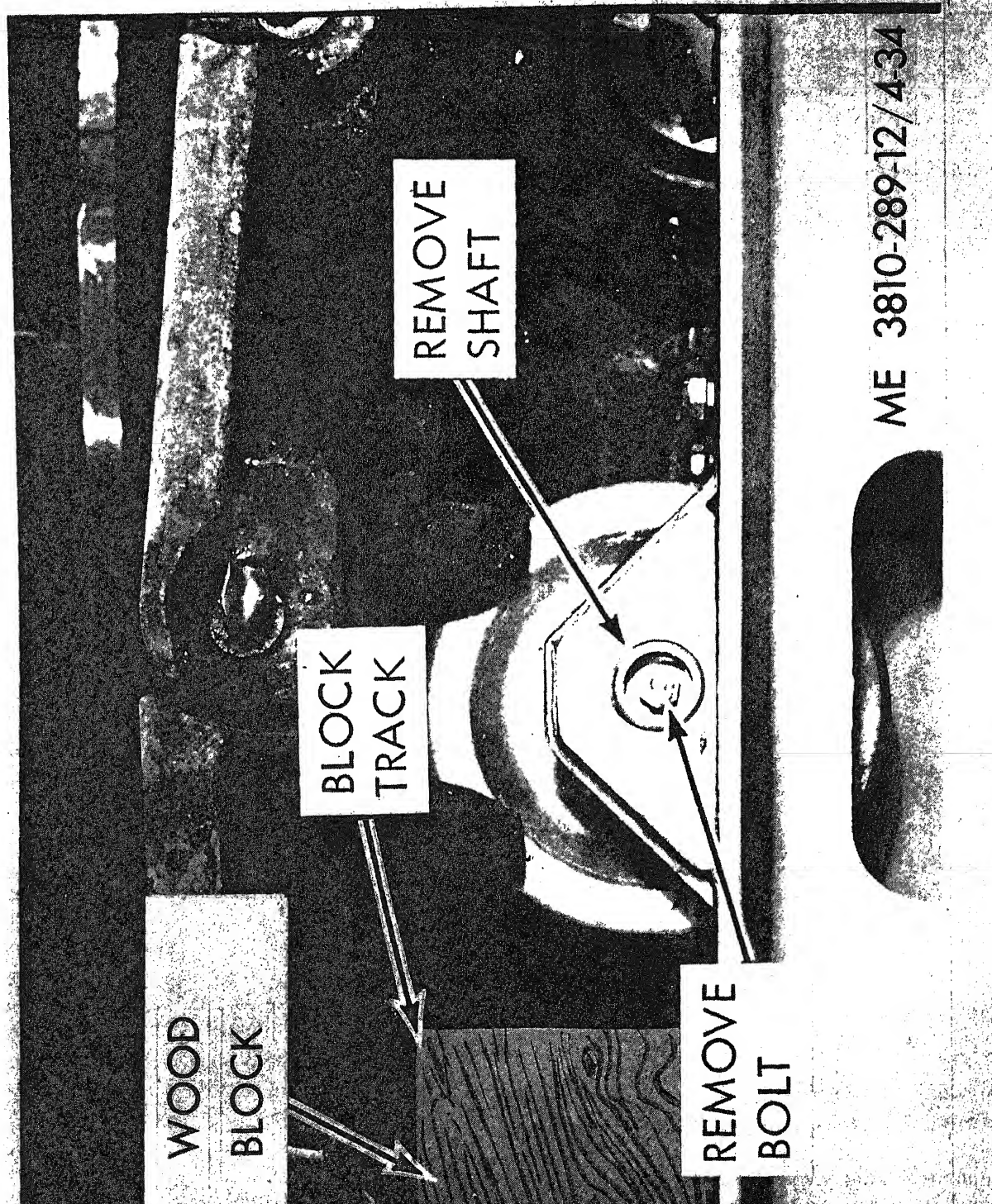
BLOCK

BLOCK
TRACK

REMOVE
SHAFT

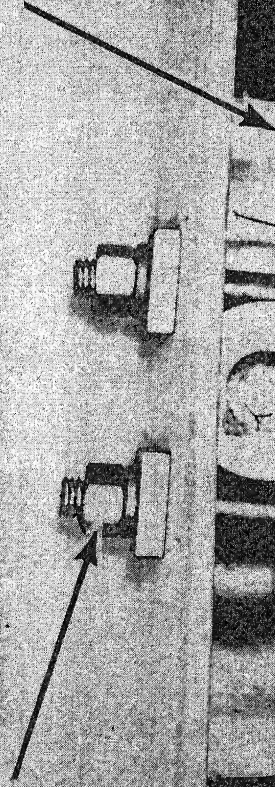
REMOVE
BOLT

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REMOVE
U BOLTS,
WASHERS,
NUTS

REMOVE ROLLER
AND SHAFT



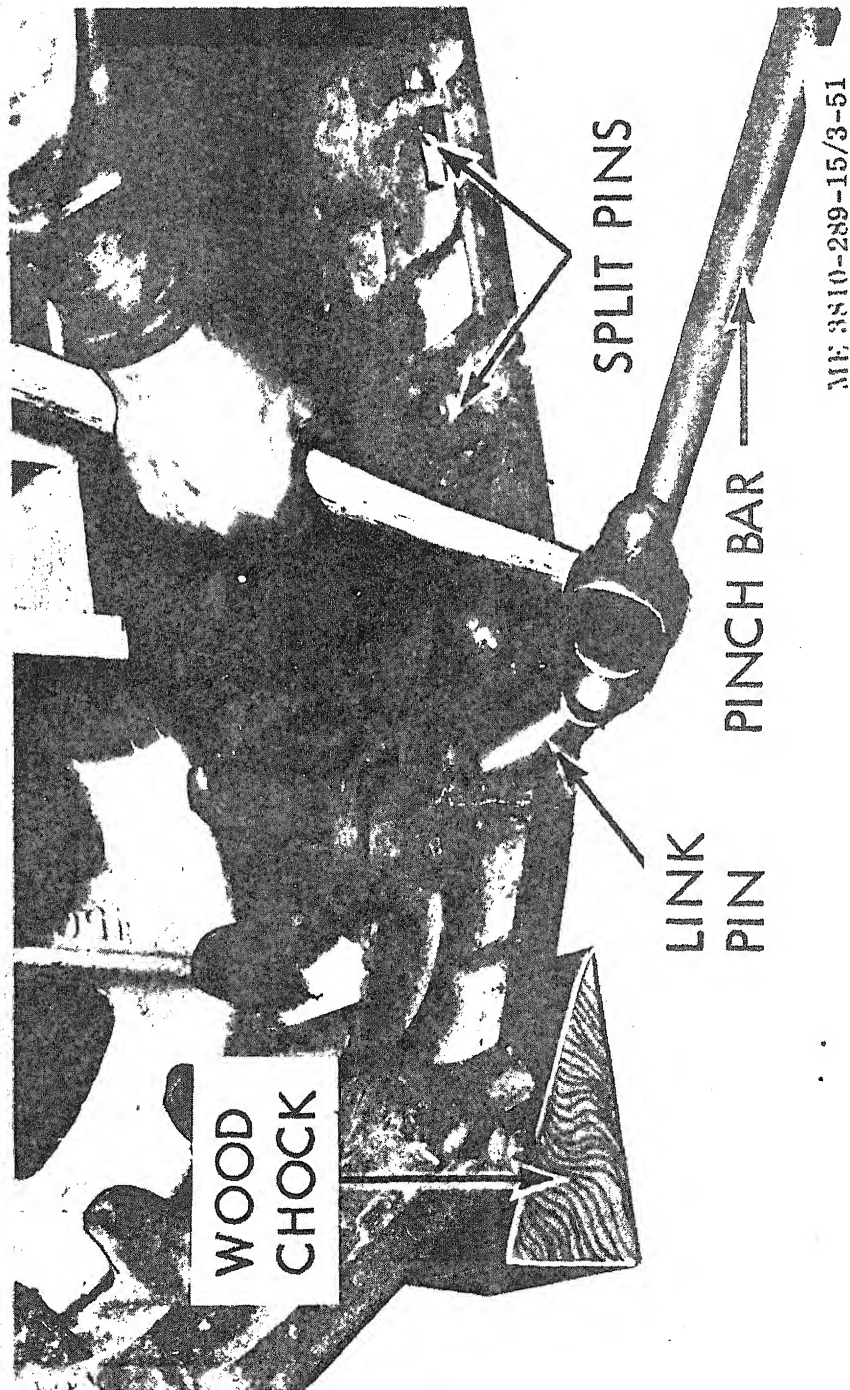


Figure 1-80. Tie rod bolt removal and installation

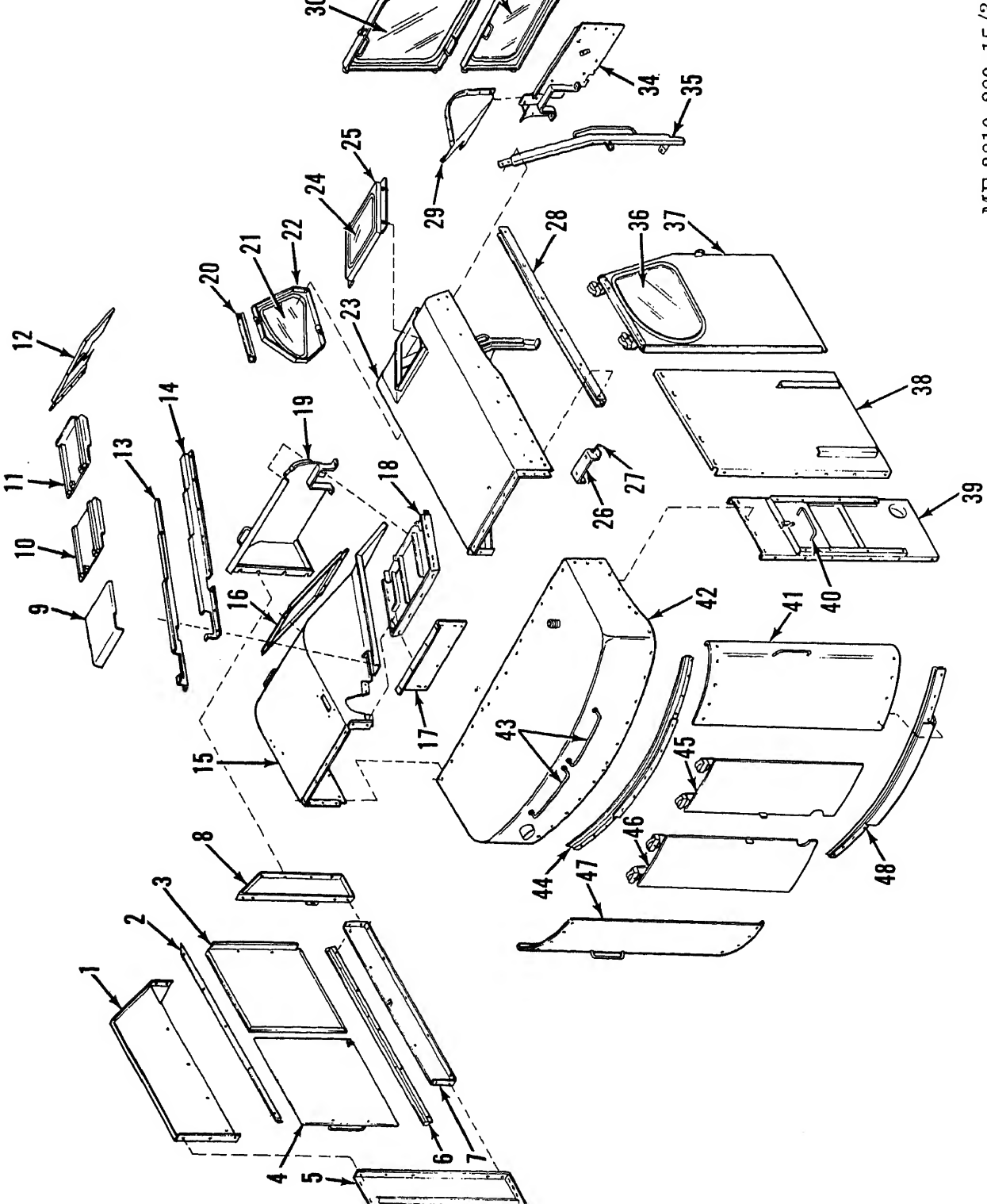
Section XIII. MAINTENANCE OF CAB COMPONENTS

4-51. Cab Assembly Replacement

Inspect for cracks and loose bolts, and check for proper operation of doors and hinged panels. Refer to figure 4-37 to replace parts of the cab assembly.

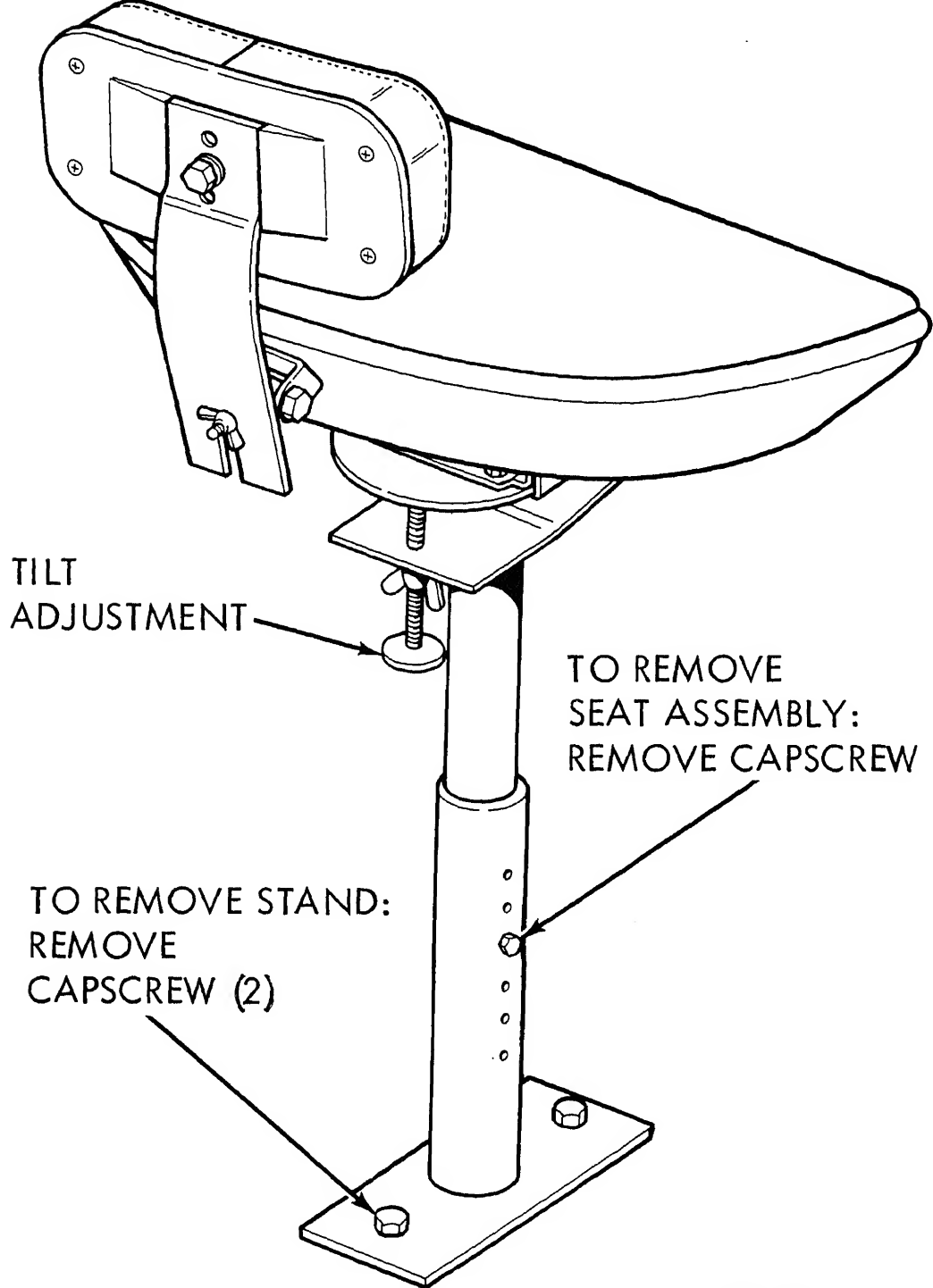
4-52. Seat Assembly Replacement and Repair

Refer to figure 4-38 to replace or repair seat assembly.



1 L.H. front panel	17 Strip	33 Sash
2 Rail, upper door	18 A-frame cover	34 R.H. front panel
3 Sliding door	19 L.H. front panel	35 Corner post
4 Sliding door	20 Strip	36 Glass
5 L.H. side panel	21 Glass	37 R.H. door
6 Rail, lower door	22 Sash	38 R.H. side panel
7 L.H. lower side panel	23 R.H. front roof	39 Radiator panel
8 L.H. front panel	24 Glass	40 Grab iron
9 Center panel cover	25 Sash	41 Corner post
10 Center panel cover	26 Spring bracket	42 Rear roof
11 Center panel cover	27 Spring bar	43 Grab irons
12 Lower center panel cover	28 Strip	44 Strip
13 L.H. guide rail	29 Lower R.H. center panel	45 R.H. rear door
14 R.H. guide rail	30 Glass	46 L.H. rear door
15 L.H. front roof	31 Sash	47 Corner post
16 L.H. front roof cover	32 Glass	48 Rear lower rail

Figure 4-37. Cab assembly.



Section XIV. MAINTENANCE OF CRANE BOOM ASSEMBLY, DRAGLINE, AND CLAMSHELL FRONT END EQUIPMENT

-53. General.

The crane, clamshell, and dragline front end attachments use a similar boom arrangements which consists of the base section and an upper section which may be lengthened by insertion of boom sections (para 4-56e). For dragline operation (para 2-18), a fairlead is installed. For clamshell operation (para 2-19), a tagline unit is used to stabilize the bucket. All of these attachments use the boom backstop, boom angle indicator, and boom harness spreader. All use drum cable lagging and cables, although size and lengths differ according to operation being performed or length of boom in use (tables 4-2 and 4-3).

-54. Crane Boom Suspension Cable

a. Removal.

- (1) Engage engine clutch and throttle engine to slowest speed.
- (2) Release locking pawl and brake by powering boom hoist drum down.
- (3) Place boom at rest on ground or block-
g.
- (4) Unspool, remaining cable from drum by
and.
- (5) Drive wedge out of drum and remove
able.
- (6) Remove cable from A-frame, pendant
bridle, and yoke sheaves.
- (7) Remove cable socket from anchor on
yoke on the A-frame.

- (8) Inspect, lubricate, and coil the cable.

b. Reeving (boom in horizontal position fig. 39)

- (1) Install one end of cable in socket which is attached to the A-frame sheave yoke.

(2) Reeve the cable from the anchor around the lower left pendant bridle sheave from left to right, then around the lower yoke sheave from left to right, then around the lower right pendant bridle sheave from left to right, around the right hand A-frame sheave from bottom to top, around the upper right hand pendant bridle sheave from right to left, through the upper yoke sheave from right to left, around the upper left hand pendant bridle from right to left, over the left hand A-frame sheave from top to bottom and then around the boom hoist drum.

- (3) Anchor the cable in the boom hoist drum socket and install wedge to take up the slack in the cable.

4-55. Crane Hoist Cable

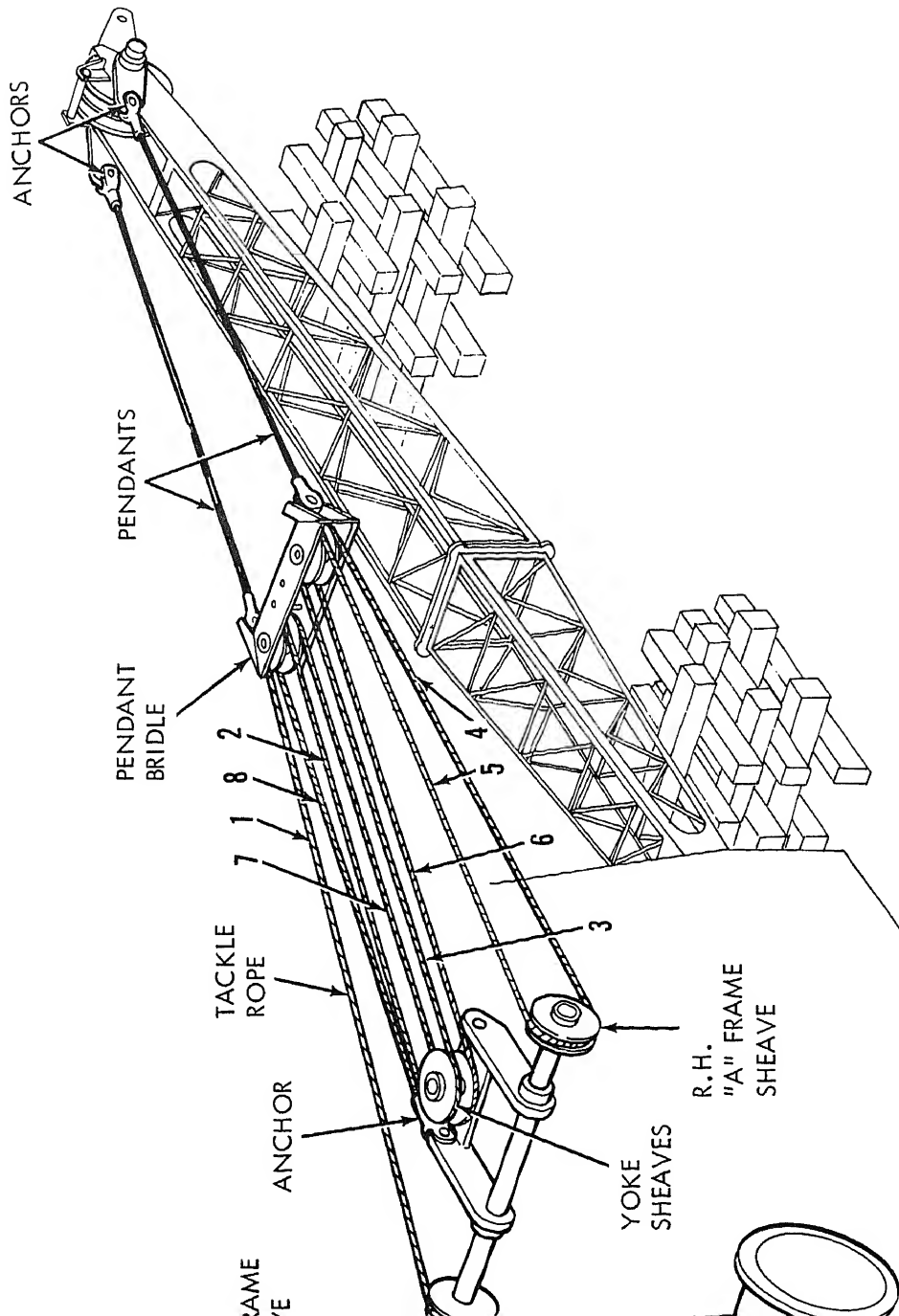
a. Removal.

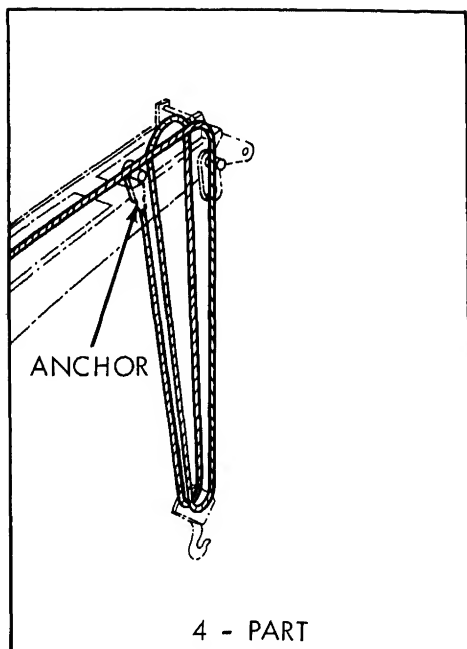
- (1) Unspool cable from the hoist drum and drive out wedge, and remove the cable from drum.

- (2) Remove cable from the boom point and hook block sheave.

- (3) Inspect, lubricate, and coil the cable.

b. Reeving (Boom in Horizontal Position). Refer to figure 4-40 and reeve the hoist cable.





ME 3810-289-12/4-40

Figure 4-40. Reeving crane hoist cable.

Table 4-2. Primary Hoist Cable Lengths

Boom length	Cable lengths (4-part)
30	250
40	300
50	350
60	400

Note. Add a 10' pendant for each additional section.

Table 4-3. Cable Specifications and Lengths

	Cable Dia. Length
Crane (30 ft).	
Boom suspension	1/2" x 241'
Primary and secondary hoist	5/8" x 250'
ragline.	
Boom suspension	Same as crane.
Hoist	5/8" x 130'
Drag	3/4" x 170'
amshell	

	Cable Dia. Length
Hoist	5/8" x 100'
Backhaul	3/4" x 26' 6"
Crowd	3/4" x 51' 6"
Dipper trip	5/16" x 35'

Note. When adding boom sections, add cable accordingly.

4-56. Boom Assembly

a. Inspection.

(1) Lower the boom and support on cribbing (fig. 3-14). Spool off a few turns of the suspension and hoist ropes so that the boom pinion sheaves can be rotated by hand.

(2) Examine all the sheaves for side wear of the rope grooves.

(3) Inspect block and hook for secure mountings and proper lubrication.

(4) Inspect crane boom for bent or damaged cords and lacings and for secure bolt mounting of butt joints. Tighten all attaching bolts and replace any that may be missing. Inspect the boom foot pins to see that they are secure.

b. Service. Lubricate all points on the boom (fig. 4-41) and the hook block, as instructed in the lubrication order.

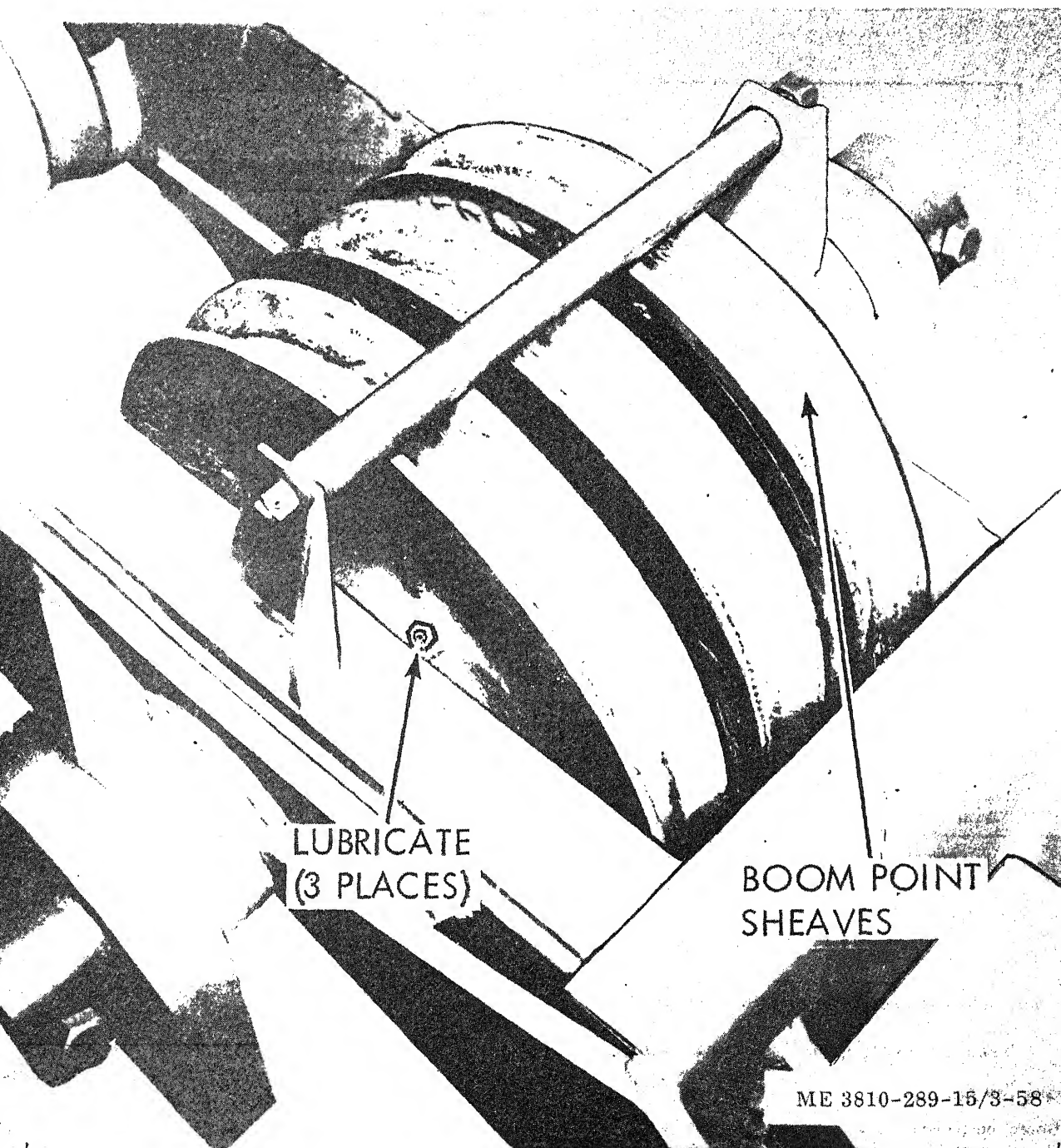
c. Removal.

(1) Remove crane hook by removing the hoist rope (para 4-55).

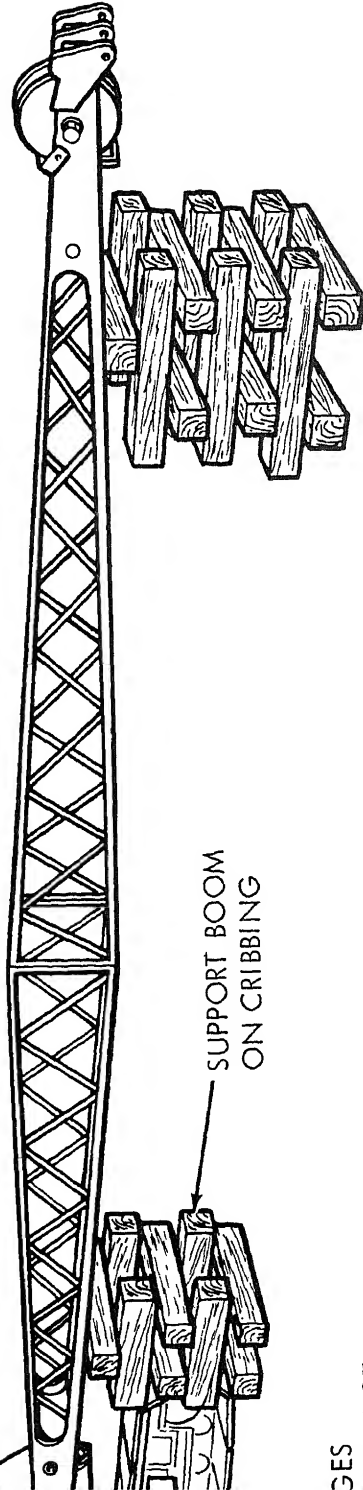
(2) Build up cribbing about four feet high which will support the boom foot and boom pinion at approximately the height at which it is attached to the revolving frame (fig. 4-32). Prop the machine up to the cribbing and lower boom suspension. Remove boom suspension rope (para 4-54).

(3) Remove lagging from front drum by taking out the six attaching bolts, nuts and lock washers.

(4) Drive wedges under boom foot as may be necessary to relieve boom foot pins of boom weight. Remove boom foot pin locking screws and take out the pins. Back machine away from boom and put pins back into revolving frame for use.



REMOVE BOOM
FOOT PINS (2)



BOOM
FOOT

ME 3810-289-15/3-59

Figure 4-42. Boom, removal.

(2) Pay off boom suspension and hoist ropes until there is sufficient slack to permit insertion of the extra sections. Remove splice bolts attaching upper and lower section of boom (fig. 4-43).

(3) By slowly propelling machine backwards, separate boom halves to permit addition of extra boom sections; put each section in place. Brace cribbing against drag of boom before propelling.) Be sure cross bracing at the ends of the section do not interfere with the track if they are installed in the boom. Bolt new sections to the upper and lower sections of the boom.

(4) Bolt pendants to boom.

(5) Raise boom to position with boom hoist.

(6) Install hoist rope in reverse order of disassembly procedure.

f. Repair. Repair of crane boom is limited to wear-out type items of the point section and minor repair or replacement of lattice members.

Note. Bent, broken or kinked booms are restricted to repair by replacement.

g. Replace. Refer to figure 4-44 to replace parts of the boom assembly.

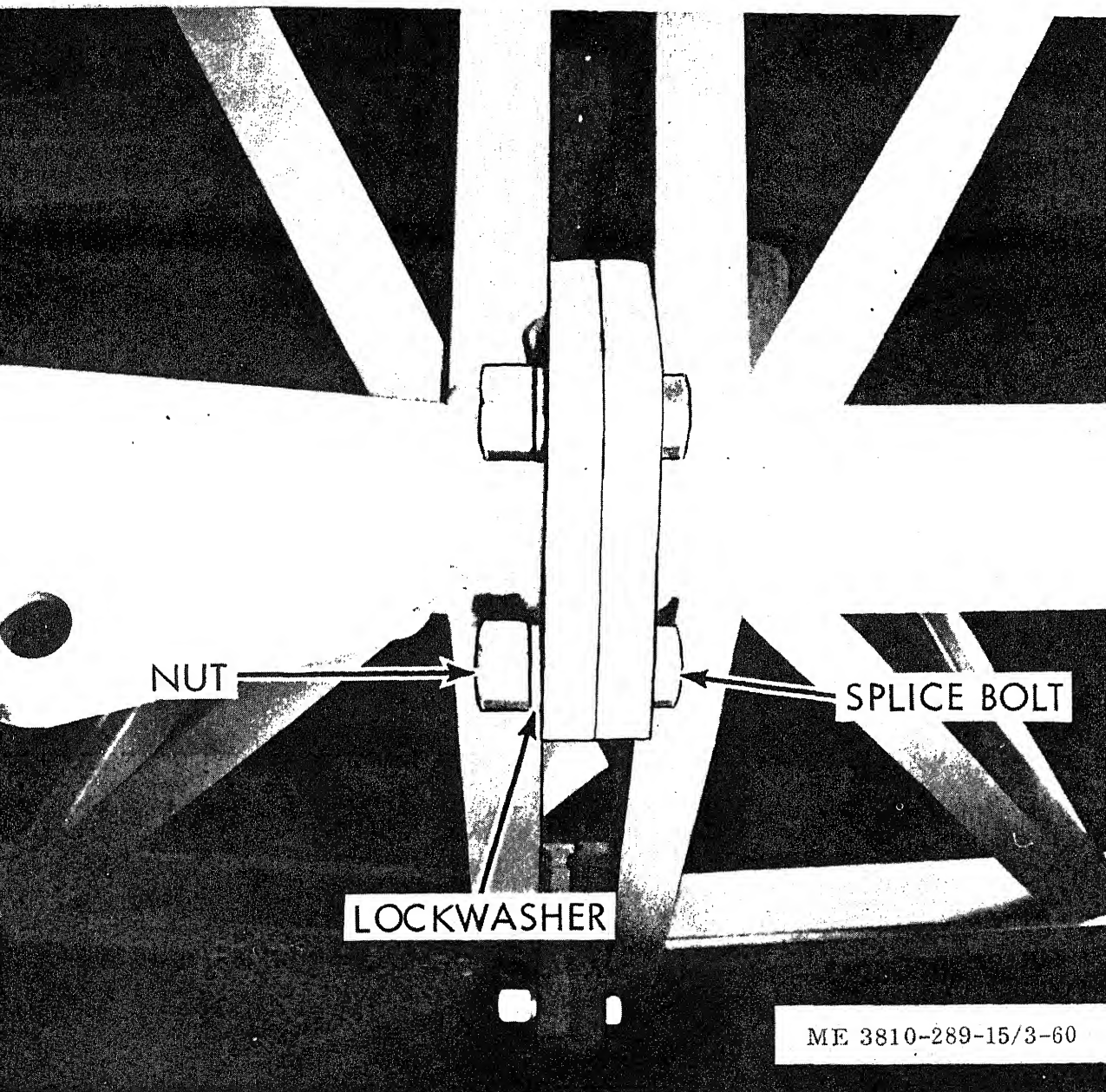
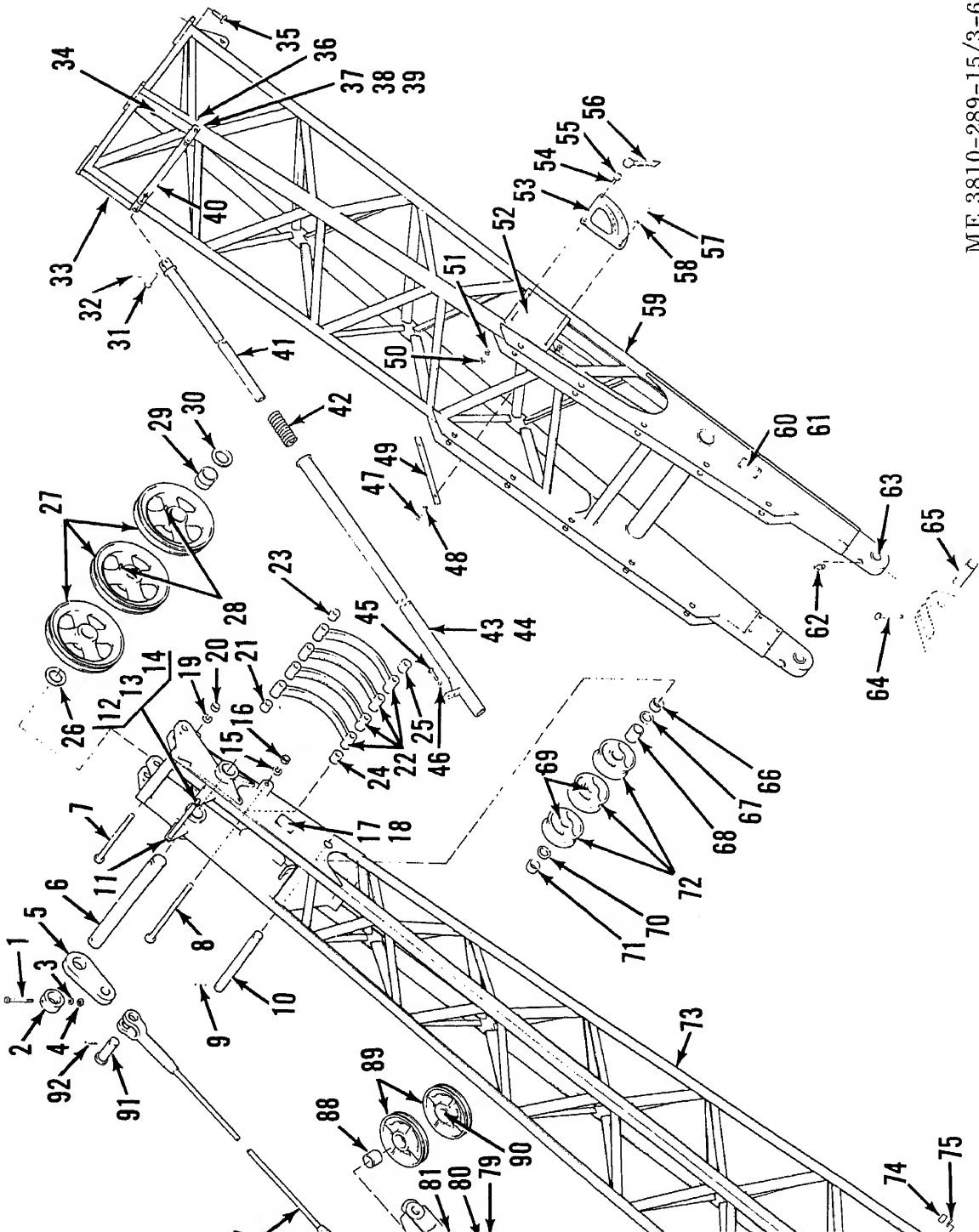


Figure 4-43. Splice bolts.



1 Screw, cap $\frac{3}{4}$ " x $5\frac{1}{2}$ " UNC C.P.	31 Pin	63 Bushing
2 Set collar	32 Pin, cotter $\frac{3}{16}$ " x $1\frac{1}{4}$ " UNC C.P.	64 Bolt, T-head
3 Washer, lock $\frac{3}{4}$ " C.P.	33 Angle	65 Boom foot pin
4 Nut, full $\frac{3}{4}$ " UNC C.P.	34 Angle	66 Spacer
5 Pendant link	35 Screw, cap $\frac{3}{4}$ " x $2\frac{1}{2}$ " UNC C.P.	67 Washer, plain 2" C.P.
6 Boom paint pin	36 Angle	68 Bushing
7 Bolt, hexagon hd. 1" x 17" UNC C.P.	37 Screw, cap $\frac{1}{2}$ " x 4	69 Bushing
8 Bolt, hexagon hd. 1" x 19" UNC C.P.	38 Washer, lock $\frac{1}{2}$ " C.P.	70 Washer, plain 2" C.P.
9 Pin, cotter $\frac{3}{8}$ " x 3 C.P.	39 Nut, full $\frac{1}{2}$ " UNC C.P.	71 Spacer
10 Pin	40 Boom stop bracket	72 Guide roller
11 Spacer	41 Upper boom stop	73 Upper boom section (15'0")
12 Screw, cap $\frac{5}{8}$ " x $14\frac{1}{2}$ " UNC C.P.	42 Spring	74 Nut, full $\frac{3}{4}$ " UNC C.P.
13 Washer, lock $\frac{5}{8}$ " C.P.	43 R.H. boom stop anchor	75 Washer, lock $\frac{3}{4}$ " C.P.
14 Nut, full $\frac{5}{8}$ " UNC C.P.	44 L.H. boom stop anchor	76 Nut, full $\frac{1}{2}$ "
15 Washer, lock 1" C.P.	45 Screw, cap $\frac{1}{2}$ " x $1\frac{3}{4}$ " UNC C.P.	77 Nut, jam $\frac{1}{2}$ " UNC
16 Nut, full 1" UNC C.P.	46 Washer, lock $\frac{1}{2}$ " C.P.	78 Spacer
17 Identification plate	47 Nut, full $\frac{3}{8}$ " UNC	79 Nut, full $\frac{3}{4}$ "
18 Screw, PK drive #4 x $\frac{1}{4}$ "	48 Washer, lock $\frac{3}{8}$ "	80 Washer, lock $\frac{3}{4}$ "
19 Washer, lock 1" C.P.	49 Brace	81 Pendant bridal
20 Nut, full 1" UNC C.P.	50 Nut, full $\frac{3}{8}$ " UNC	82 Sheave
21 Spacer	51 Washer, lock $\frac{3}{8}$ "	83 Screw, cap $\frac{3}{4}$ " x 9 UNC
22 Cable guard	52 Boom angle indicator bracket	84 Screw, cap $\frac{1}{2}$ " x 2 UNC
23 Spacer	53 Indicator	85 Sheave pin
24 Spacer	54 Pivot	86 Fitting & lubrication
25 Spacer	55 Bearing	87 Pendant
26 Washer, thrust	56 Pointer	88 Bushing
27 Sheave	57 Screw, cap $\frac{3}{8}$ " x $1\frac{1}{4}$ UNC	89 Sheave
28 Fitting, lubrication $\frac{1}{8}$ "-45°	58 Washer, lead $\frac{3}{8}$ "	90 Bushing
29 Bushing	59 Lower boom section (15'0")	91 Pin
30 Washer, thrust	60 Identification plate	92 Pin, cotter
	61 Screw, cap $\frac{3}{4}$ " x 8" UNC	
	62 Fitting, lubrication	

Figure 4-44. Boom assembly, exploded view.

4-57. Safety Boom Stop, Replacement and Repair

Refer to figure 4-44 to replace or repair the safety boom stop.

4-58. Dragline Bucket

a. Removal.

(1) Lower dragline bucket to ground, then slacken hoist and drag cables.

(2) Remove drag, hoist, and dump cables from dead ends (fig. 2-11).

(3) Wind cables on drum, slowly, as cable ends are guided through sheaves.

b. *Disassembly.* Refer to figure 4-45 and disassemble bucket.

c. *Cleaning, Inspect, and Repair.*

(1) Clean parts with an approved cleaning solvent and dry thoroughly.

(2) Replace defective parts.

d. *Bucket Teeth Replacement.*

(1) Position bucket on its side and remove

f. *Installation.*

(1) Reeve drag, hoist, and dump cable (2-11).

(2) Connect cables to dead ends.

4-59. Dragline Fairlead

a. *Removal.* Refer to figure 2-10 and remove fairlead.

b. *Disassembly.* Refer to figure 4-46 and disassemble fairlead.

c. *Cleaning, Inspection and Repair.*

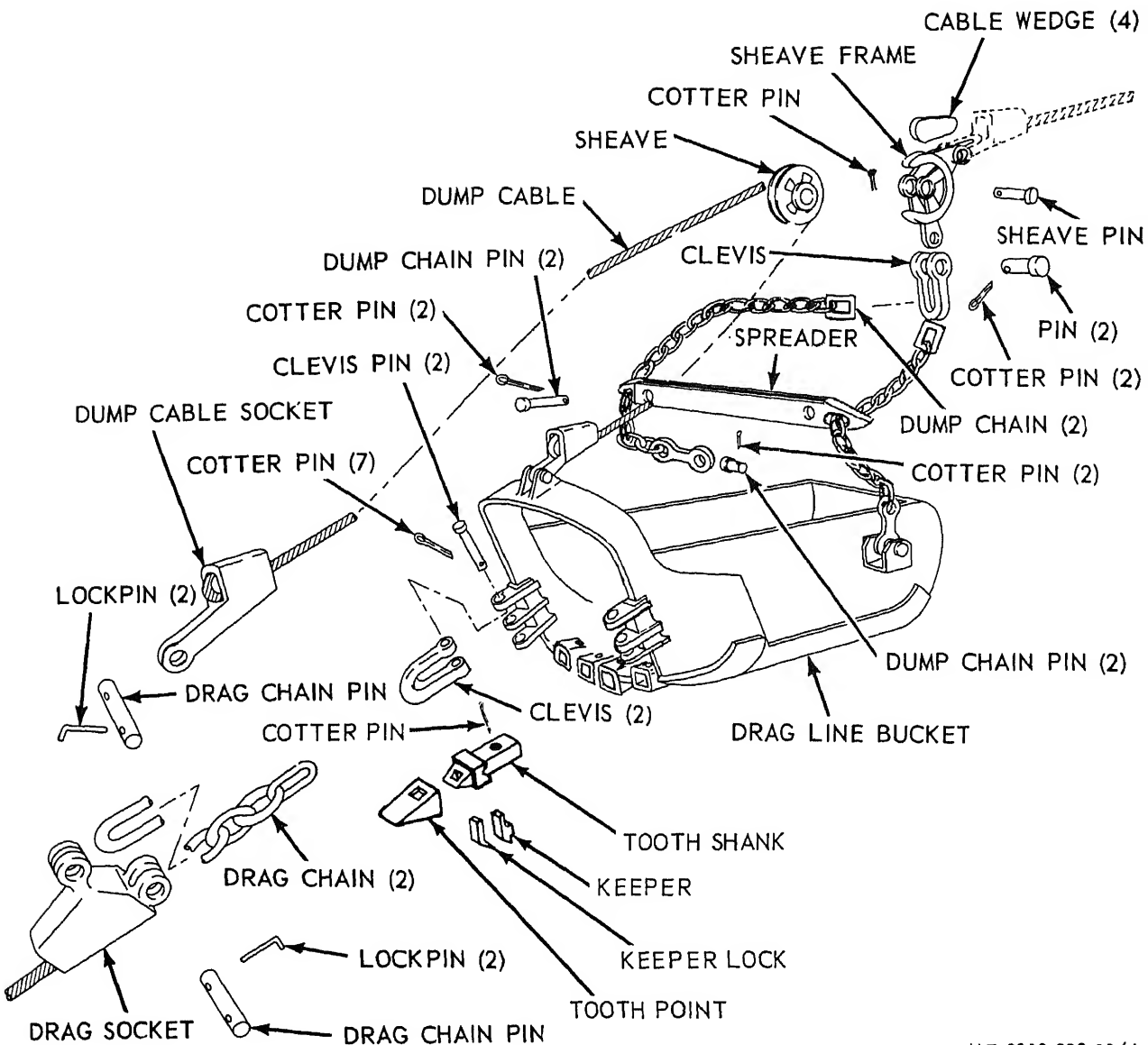
(1) Clean parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect bushings and bearings for wear and scoring.

(3) Inspect sheave shafts and sheaves for wear, cracks, or bends.

(4) Inspect mounting base and frame for bends, cracks, or breaks, and mounting hardware for stripped threads, elongated hole, or other defects.

(5) Repair by welding cracks or by replacing defective parts.



ME 3810-289-12/4-

Figure 4-45. Dragline bucket, disassembly and reassembly.

two half-scoops, hinged together at top so that they will close over material to be picked up. Bucket opens when closing line is allowed to run free, and closes when pressure on hoist brake is slackened and crowd and retract clutch is engaged.

b. Removal.

d. Bucket Teeth Replacement.

(1) *Removal.* Position bucket on its side. Remove nuts, lockwashers and bolts, and remove teeth from clam jaws.

(2) *Cleaning, inspection and repair.*

(a) Clean parts with an approved cleaning solvent and dry thoroughly.

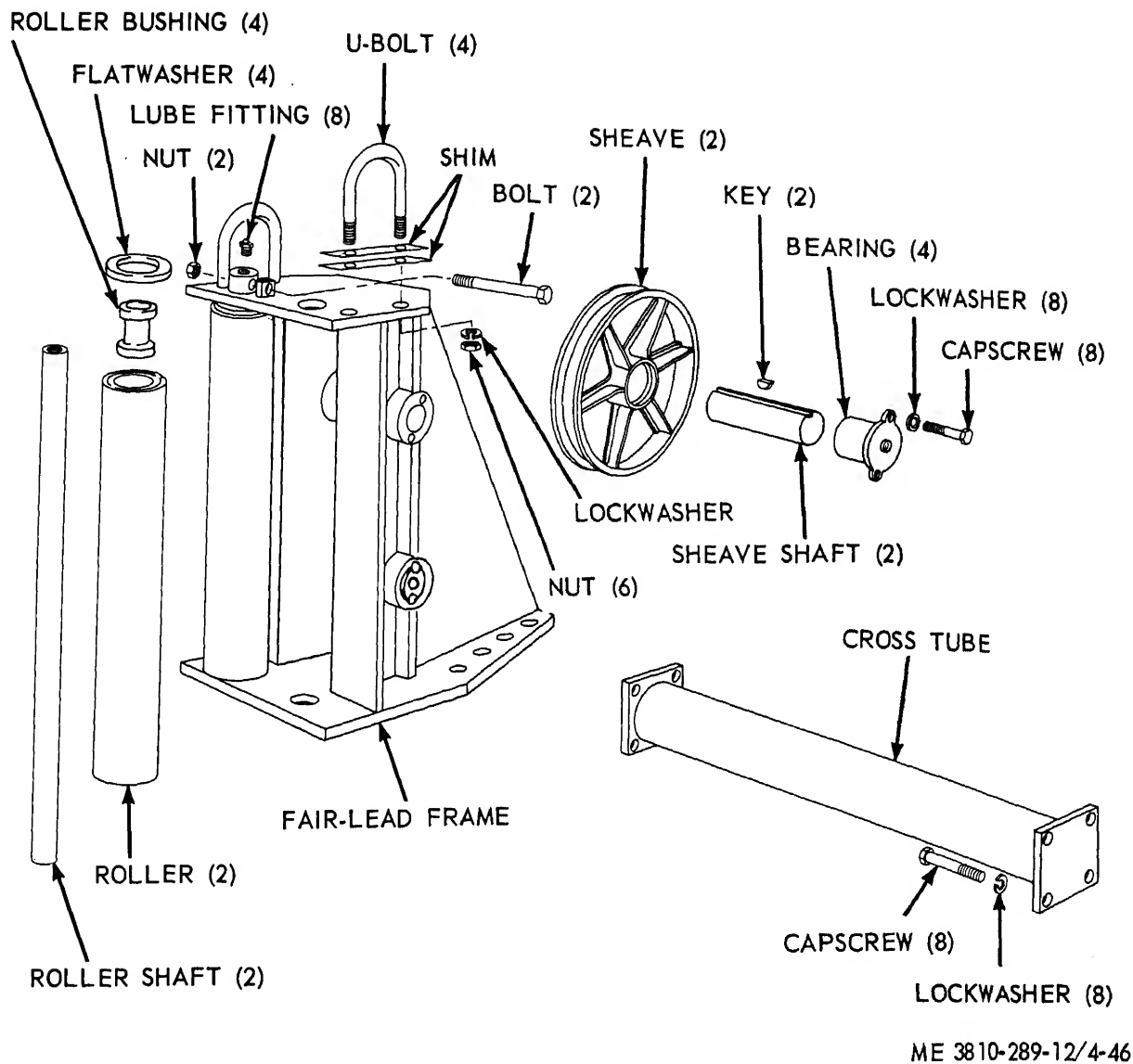


Figure 4-46. Dragline fairlead, disassembly and reassembly.

e. Reassembly. Refer to figure 4-47 and reassemble clamshell bucket.

f. Installation.

(1) Position boom over bucket. Reeve the opening and closing cables (fig. 2-14), and secure dead end sockets on bucket.

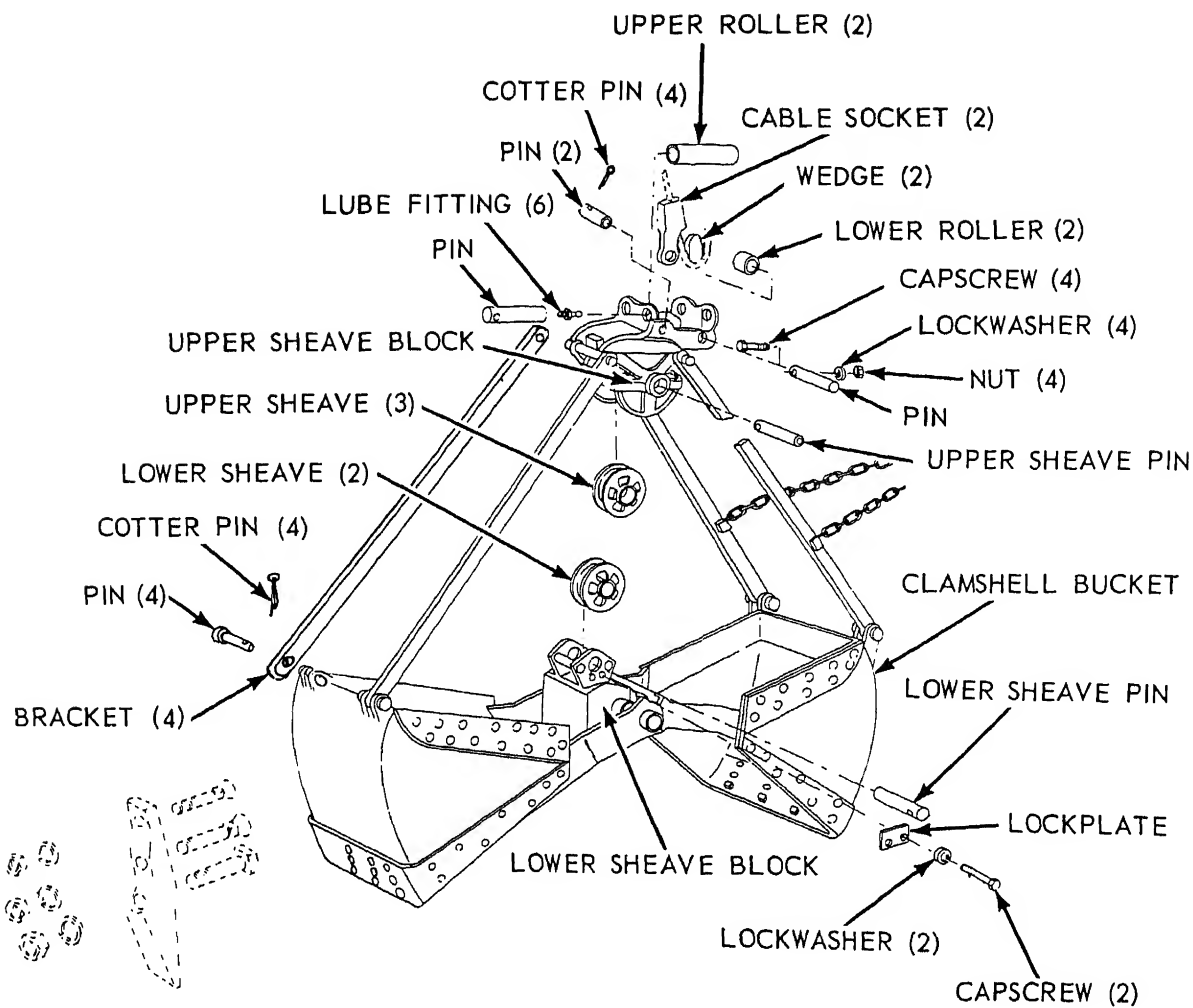
(2) Attach tagline to bucket.

(3) Remove weighted hook from cable.

(4) Remove jib cable from jib boom and right-hand drum.

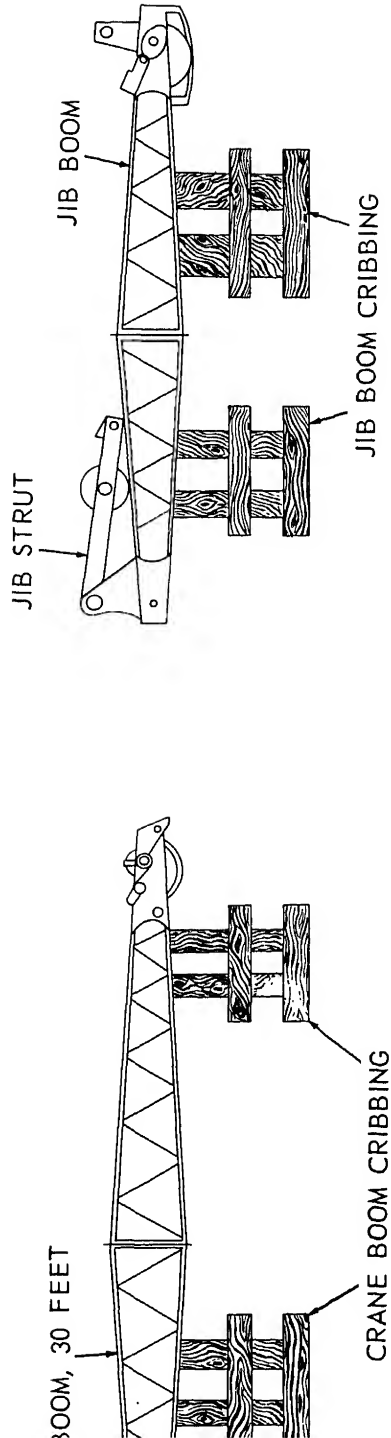
(5) Remove two cotter pins, capscrows, lockwashers, jib boom pins, and jib boom, from the crane boom. Remove the two rod ends from jib boom pins.

h. Disassembly. Refer to figures 4-49 and 4-



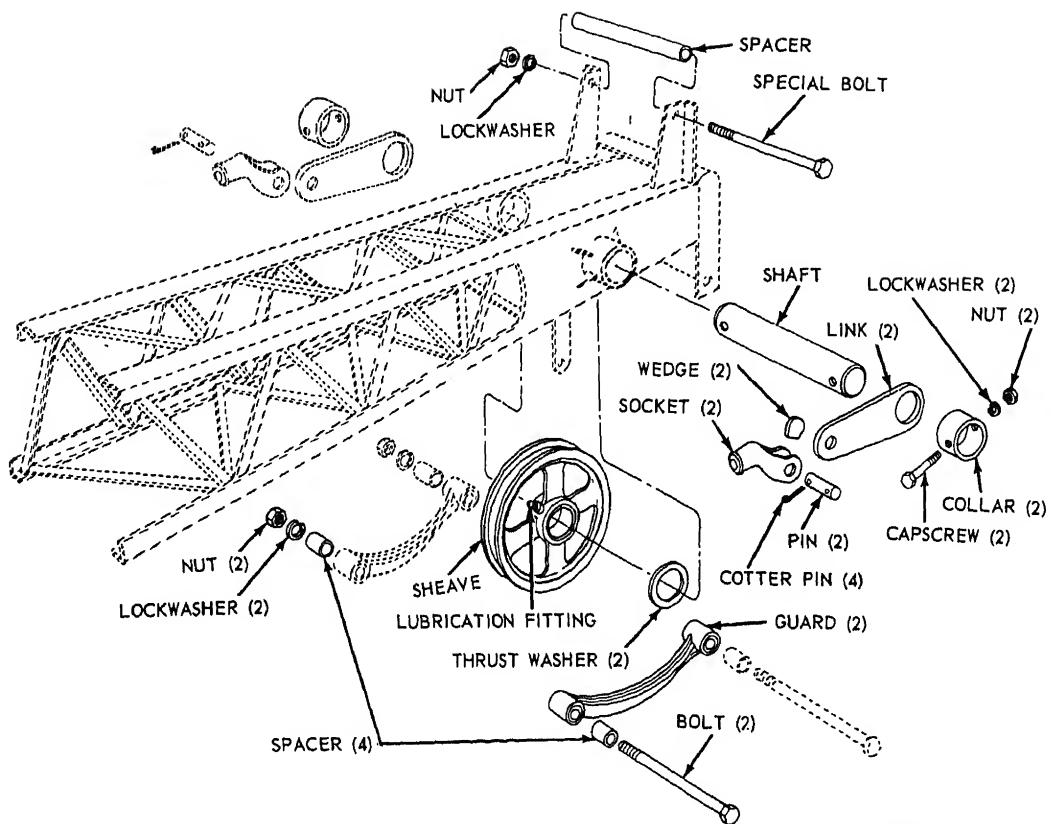
ME 3810-289-12/4-47

Figure 4-47. Clamshell bucket, disassembly and reassembly.



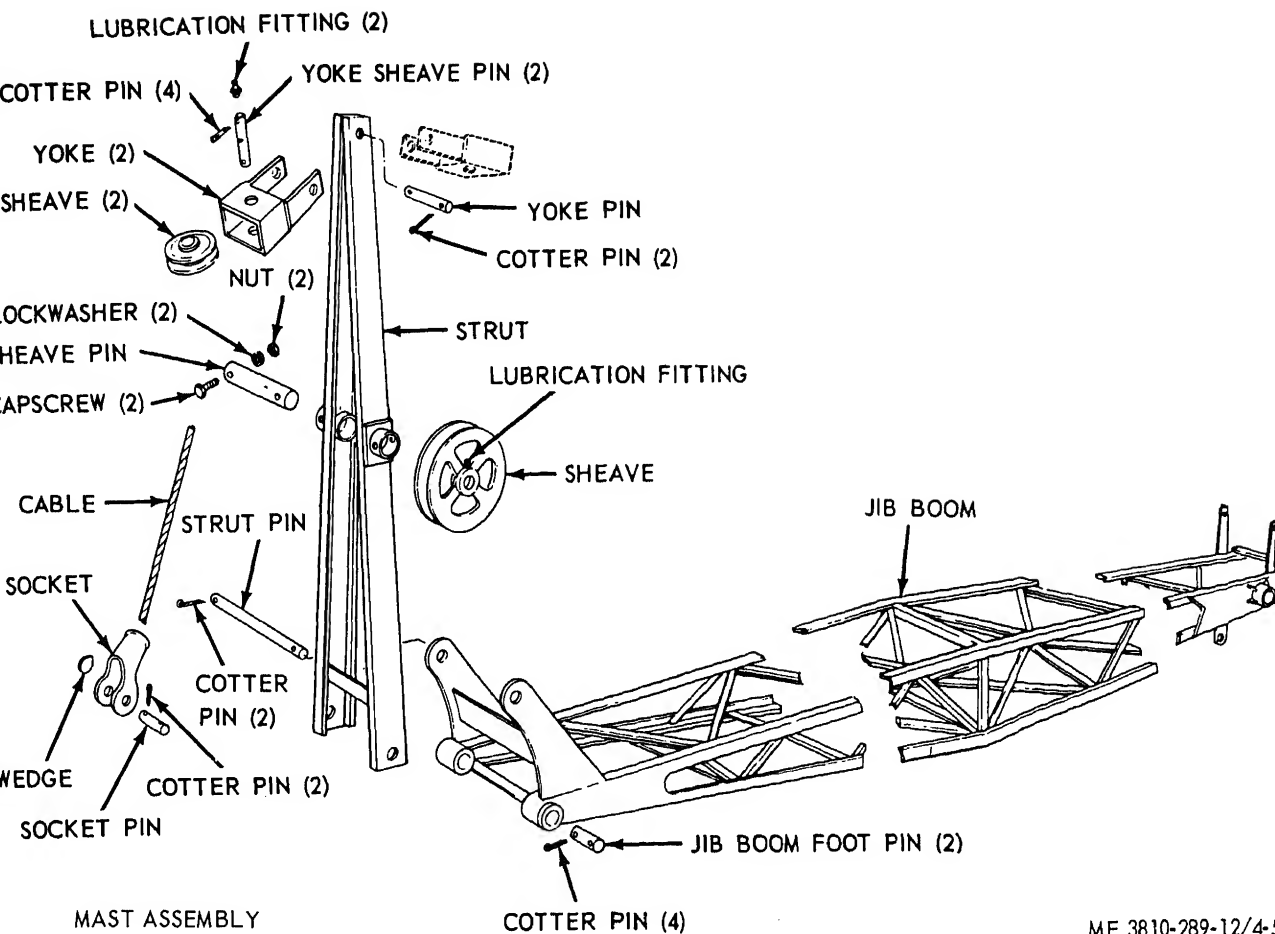
SURE CRIBBING IS SET
 RM GROUND TO AVOID
 TTING OF BOOM, CAUSING
 Y TO PERSONNEL AND
 SE TO ATTACHMENT.

Figure 4-48. Boom cribbing method.



ME 3810-289-12/4-49

Figure 4-49. Jib boom assembly, exploded view.



ME 3810-289-12/4-3

Figure 4-50. Jib boom mast assembly, exploded view.

d. *Reassembly.* Refer to figures 4-49 and 4-50 and reassemble jib boom and mast.

e. *Installation.* Install jib boom (para 2-3c).

Section XV. MAINTENANCE OF CLUTCH AND BRAKE ASSEMBLIES

4-62. Operating Clutch Band, Removal and Installation

- a. Refer to figure 4-51 to remove and install the clutch band.
- b. Refer to paragraph 3-27 for clutch adjustment.

4-63. Boom Hoist Clutch Band, Removal and Installation

a. *Booster Band Removal.*

- (1) Remove booster band joint bolt (10, fig. 4-51).
- (2) Remove booster band clutch adjusting nuts (4).
- (3) Remove cushion spring nut (11), and cushion spring (6).
- (4) Remove both sections of the booster band (1).

b. *Clutch Band Removal.*

- (1) Remove booster band (a, above).
- (2) Remove clutch release spring (13, fig. 4-51) and take off band guides (8).
- (3) Take out the four cotter pins (14) holding the main clutch bellcrank (9) in place.
- (4) Slide main clutch band (12) out of housing and separate at splice, if necessary.

c. *Installation.*

(1) The main clutch band and booster band are installed in reverse of the removal procedure.

(2) When installing a replacement booster band, place band halves in place and connect band at splice at joint, leaving bolt (10, fig. 4-51) one-half thread loose. Lock adjusting nuts (4) at location where circumference of band matches circumference of booster drum. Then, with the cushion spring (6) and booster band released, install spring in place, tighten the cushion spring nuts (11) for 0.010-inch gap between the cam and booster band cam roller (3).

d. *Adjustment.* Refer to paragraph 3-29.

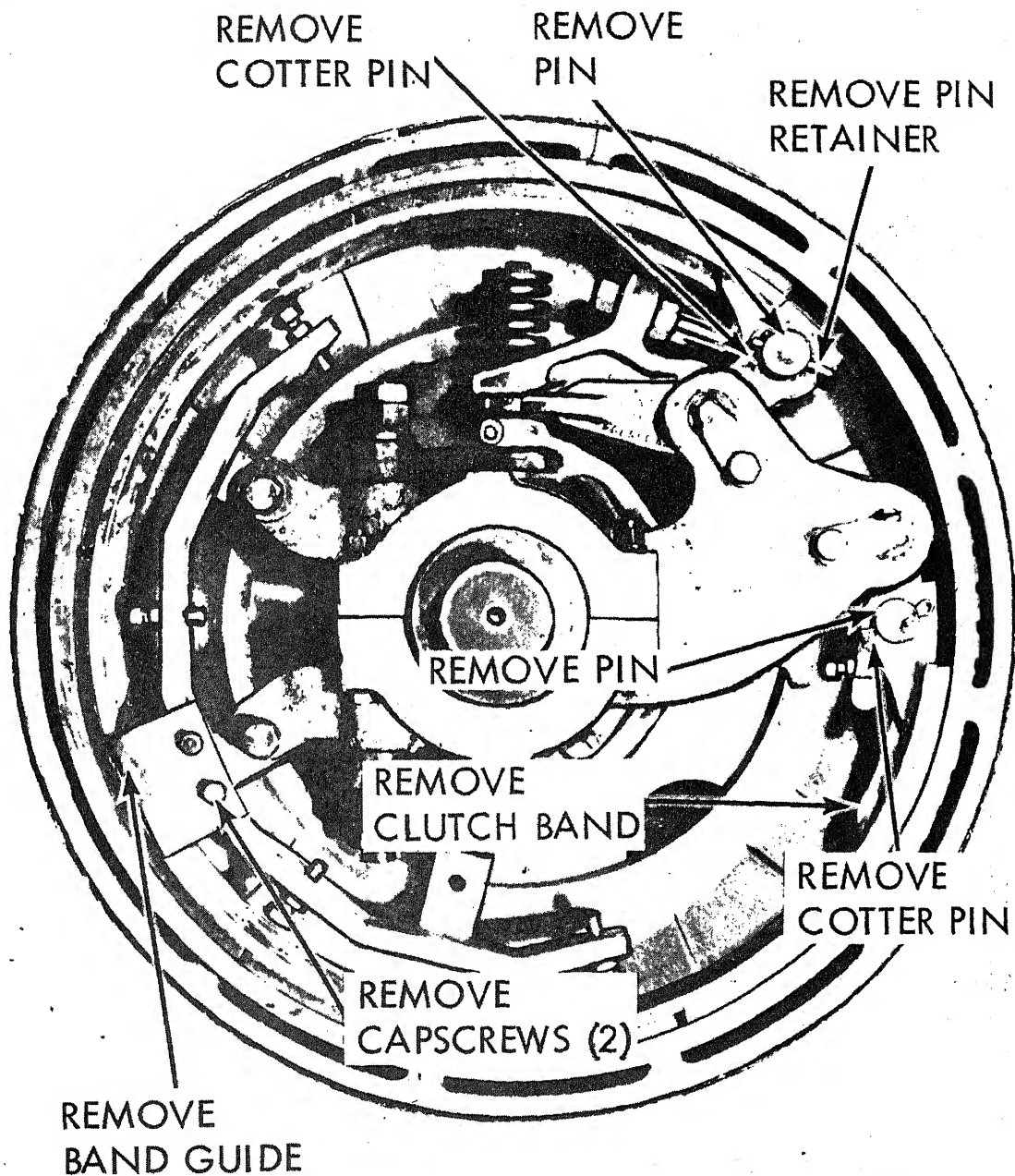
4-64. Boom Hoist Brakeband, Removal and Installation

a. *Removal.*

- (1) Remove guard.
- (2) Remove brakeband joint bolt (10, fig. 4-51).
- (3) Remove dead-end pin (7).
- (4) Remove brakeband adjusting nuts (4).
- (5) Remove both sections of the brakeband (2).

b. *Installation.* The brakeband is installed in reverse of the removal procedure.

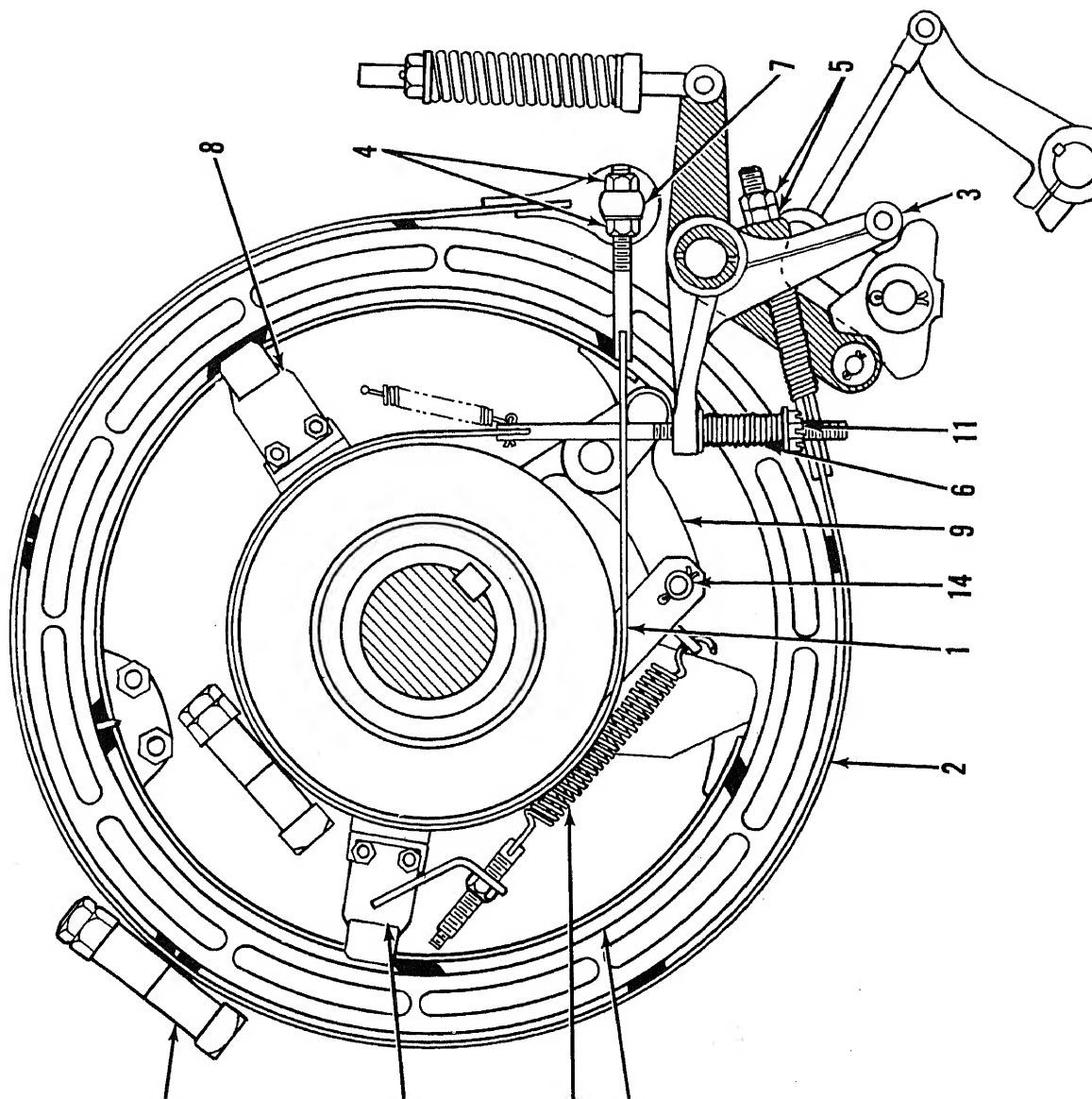
c. *Adjustment.* Refer to paragraph 3-30.



ME 3810-289-15/3-64

Operating clutch band.

Figure 4-51. Clutch and brakebands, removal and installation (sheet 1 of 2).



Booster band	6 Cushion spring	11 Cushion spring nut
Brakeband	7 Dead end pin	12 Main clutch band
Booster band cam roller	8 Band guides	13 Clutch release spring
Booster band clutch adjusting nuts	9 Main clutch bellcrank	14 Cotter pins
Brakeband adjusting nuts	10 Booster band joint bolt	

Boom hoist clutch and brakebands.

Figure 4-51. Clutch and brakebands, removal and installation (sheet 2 of 2).

Section XVI. MAINTENANCE OF CHAIN CASE ASSEMBLY, CONE ROLLERS, AND GEAR CASE COVERS

4-65. Chain Case Assembly

a. Check chain case for cracks, breaks, and defective plugs, or hardware.

b. Replace defective drain or oil level plugs or hardware (fig. 4-52).

c. Lubricate in accordance with current lubrication order.

4-66. Cone Roller Replacement

a. *Removal* (fig. 4-53).

(1) Lift upper works just enough so cone rollers are free in their path. Lift can be made as follows:

(a) Crane with sling fastened to lifting eyes provided on A-frame yoke and lugs near bottom foot pins.

(b) Jacking up revolving frame and building cribbing to support it. Four jacks should be used, one under each corner of revolving frame (do not jack against light constructed decks).

(2) Remove lockwire, nut, and washer.

(3) Remove cone roller, bushing, O-ring, and container.

b. *Installation.*

(1) Refer to figure 4-53 and reassemble in numerical order.

(2) Check to be sure that rollers turn freely.

(3) Install washer, nut, and lockwire.

4-67. Frame and Bevel Gear Case Covers Replacement

a. *Frame Covers.* Refer to figure 4-54 and 4-55 to replace the frame covers.

b. *Bevel Gear Case Cover* (fig. 4-56).

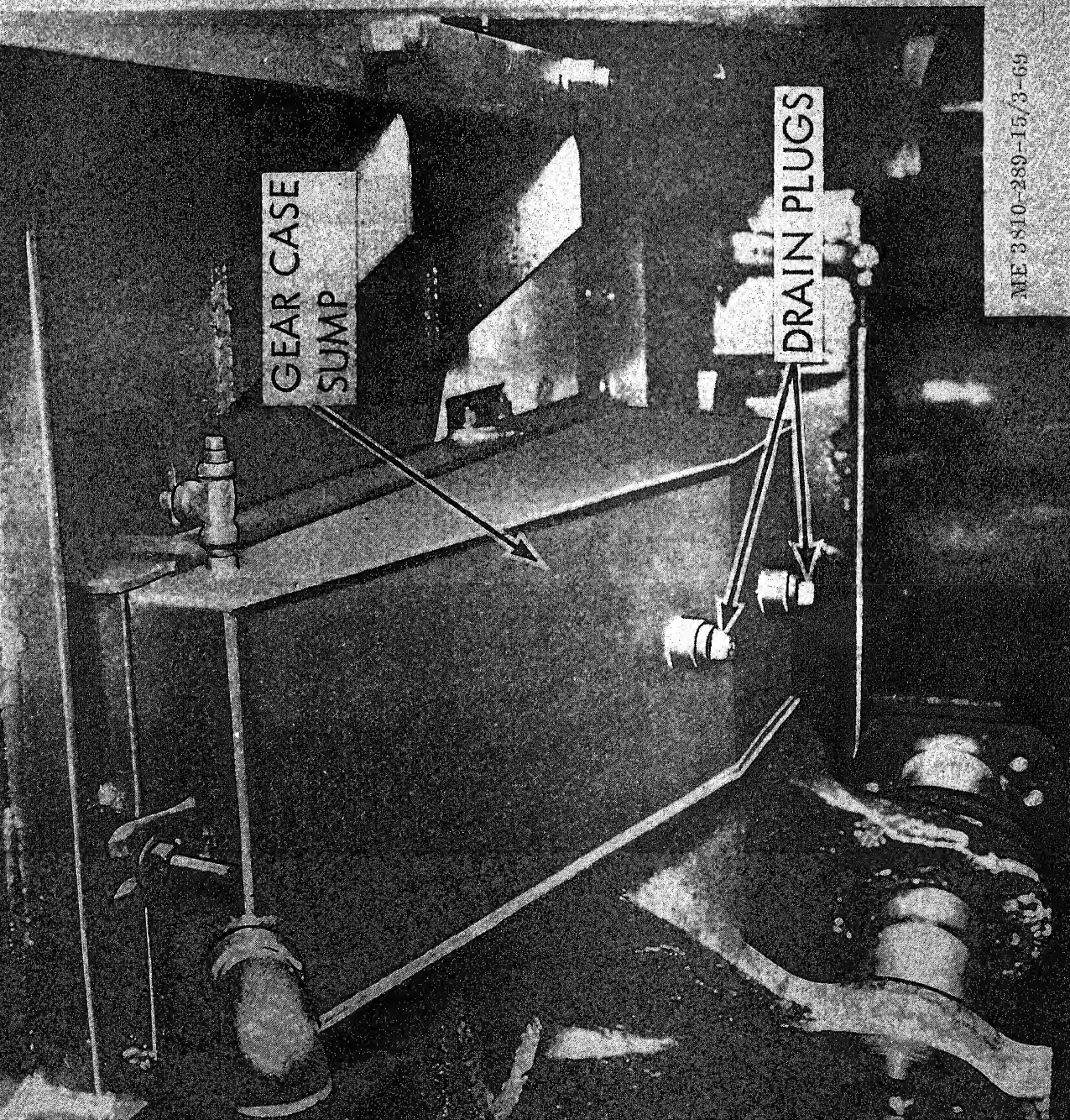
(1) Remove drain plug in bottom of bevel gear case and drain lubricant into clean container for replacement. Cover container with lubricant in it for protection against dust and other foreign matter.

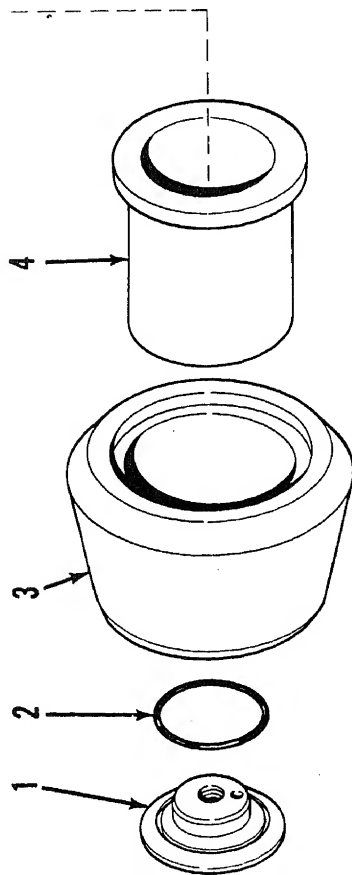
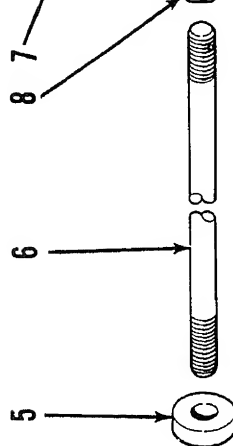
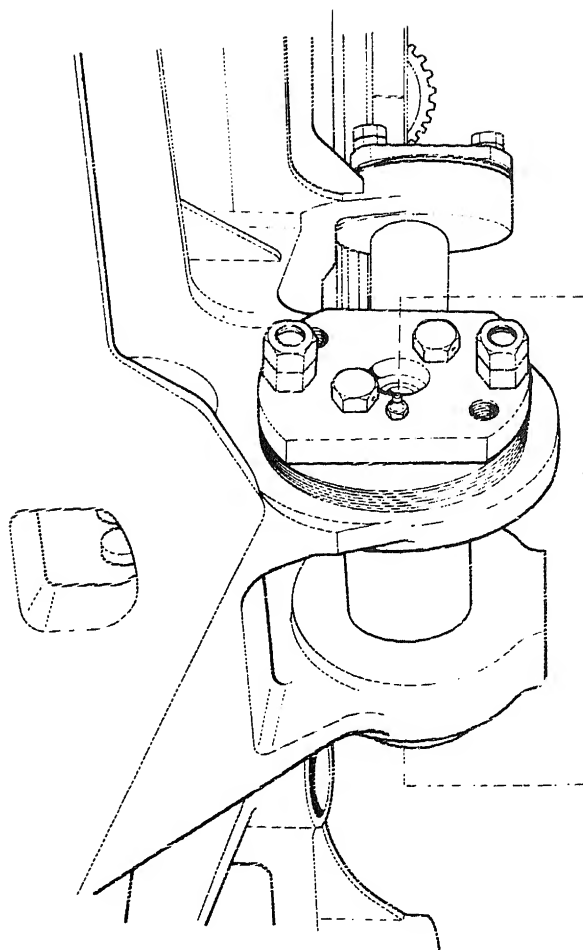
(2) Remove four bolts attaching gear case to truck frame and lower the case with steering clutch guards attached. Clean the gasket off from truck frame and gear case.

(3) Installation is the reverse of the removal instructions.

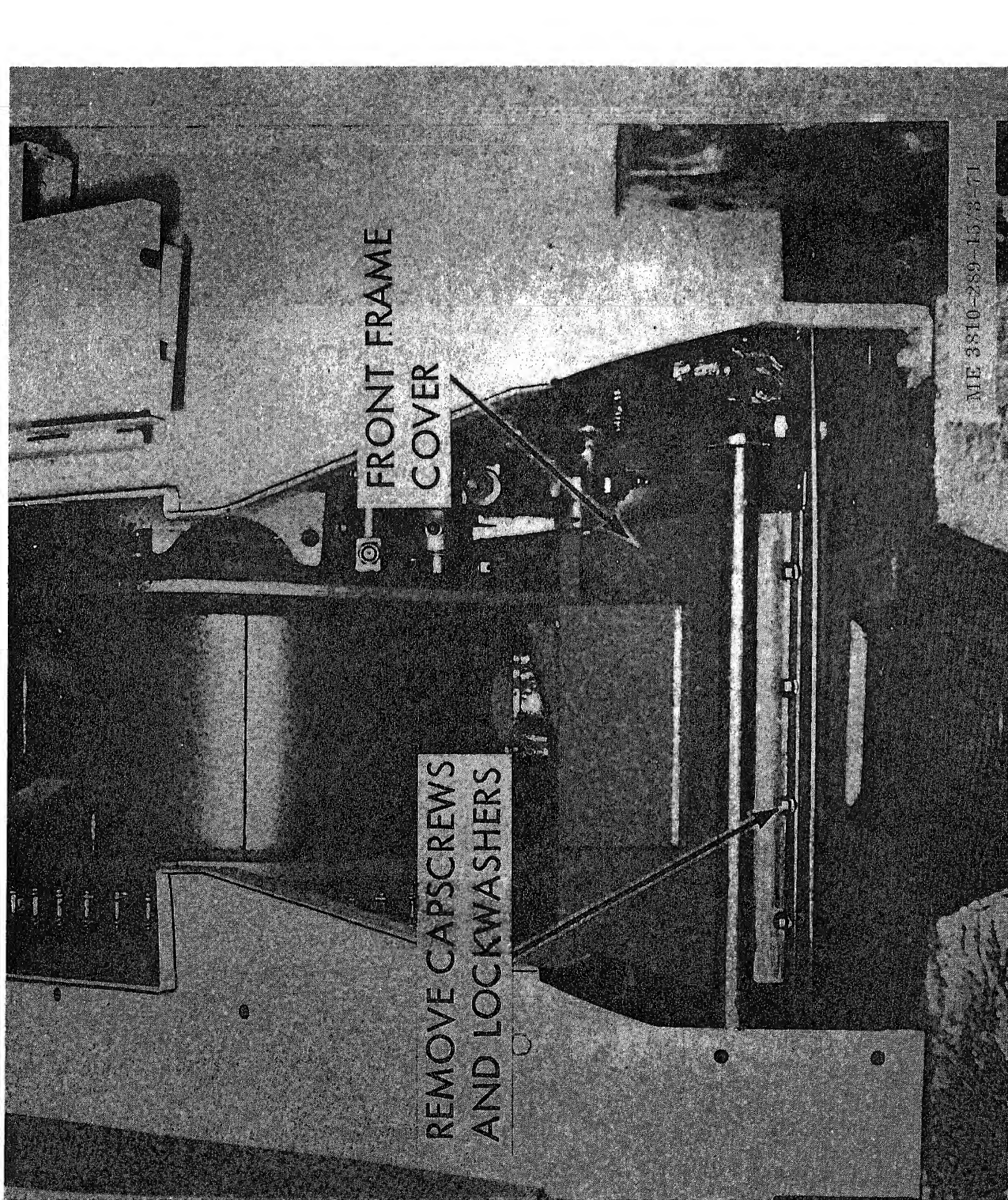
GEAR CASE
SUMP

DRAIN PLUGS





ME 3810-289-1



REMOVE CAPSCREWS
AND LOCKWASHERS

FRONT FRAME
COVER

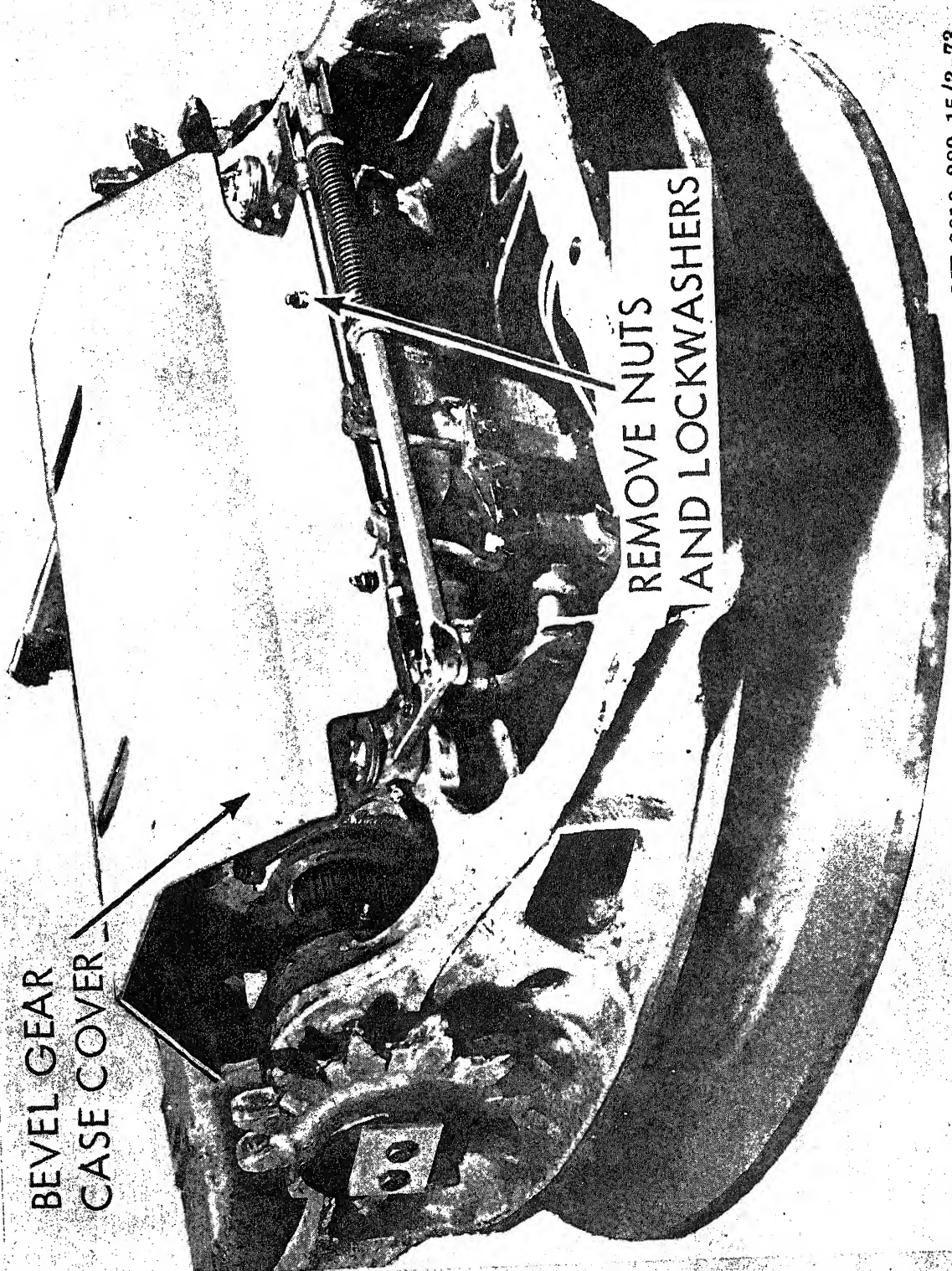
REMOVE
CAPSCREWS
AND LOCKWASHERS

REAR FRAME
COVER

BEVEL GEAR
CASE COVER

REMOVE NUTS
AND LOCKWASHERS

ME 3810-289-15/3-73



g the shovel front end equipment and for maintenance of components. For front end conversion to a shovel, refer to paragraph 2-8.

b. Refer to paragraph 1-4f for description of the shovel front end equipment.

c. Use a crane or other adequate lifting device for removing and installing components of the shovel front end attachment.

4-69. Replacement of Shovel Front End Equipment

a. Removal.

(1) Lower boom on support cribbing (fig. 4-22).

(2) Remove shovel dipper and boom suspension cables (fig. 2-23).

(3) Remove front crowd chain (fig. 2-20).

(4) Remove boom foot locking bolts and pins.

(5) Propel machine slowly backward until boom foot is separated from lugs on revolving frame.

b. Cleaning, Inspection and Repair.

(1) Clean and inspect boom assembly, dipper, and handle, for damaged or missing parts. Lubricate in accordance with current lubrication order.

(2) Repair or replace damaged or defective components.

c. *Installation.* Installation procedure is reverse of removal, a, above.

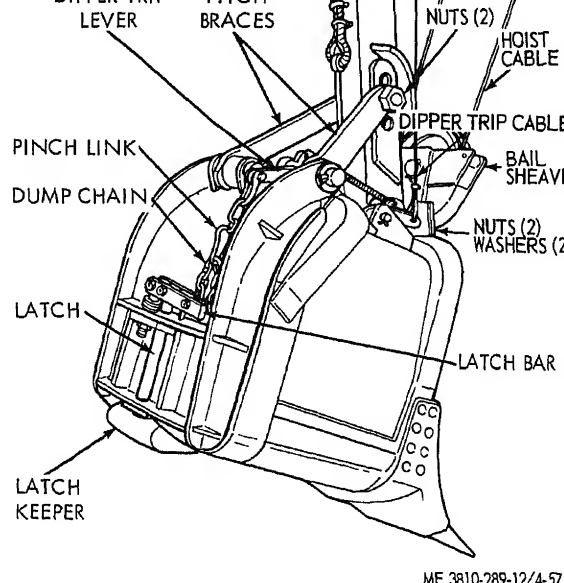
4-70. Shovel Dipper and Padlock

a. Removal.

(1) Lower dipper to rest on blocks, then remove hoist cable from bail sheave (fig. 4-57).

(2) Disconnect trip cable from trip lever. Remove nuts from pins securing braces to dipper handle, and remove pins.

(3) Remove nuts and washers from pin securing dipper to handle. Remove handle pin and remove dipper and padlock from handle.



ME 3810-289-12/4-57

Figure 4-57. Shovel dipper assembly, removal and installation.

4-71. Shovel Dipper Handle

a. *General.* The dipper handle, with the saddle lock, is attached to the shipper shaft at the center of the boom and provides crowd action and support for the dipper.

b. Removal.

(1) Lower dipper to rest on blocks and remove hoist cable from bail sheave (fig. 4-57).

(2) Disconnect trip cable from trip lever. Remove nuts from pins securing braces to dipper handle and remove pins.

(3) Remove front crowd chain (fig. 2-20).

(4) Lash saddle block to boom to prevent from changing angles when dipper handle is removed from shipper shaft.

(5) Attach lifting sling to handle with end of sling attached three feet from each end handle. Attach sling to lifting device.

(6) Remove cable guard from end of handle.

(7) Back machine, slowly, until the handle is pulled from the saddle block.

(8) Remove cotter pins and washers from handle pins. Remove handle pins and handle from dipper.

consist primarily of a shaft, bushings, saddle block, and wear bars.

b. Removal.

(1) Remove dipper and handle (para 4-71).

(2) Attach lifting sling to saddle block and hoist. Attach sling to lifting device.

(3) Remove shipper shaft bushing and lift saddle block and sheave from shovel boom.

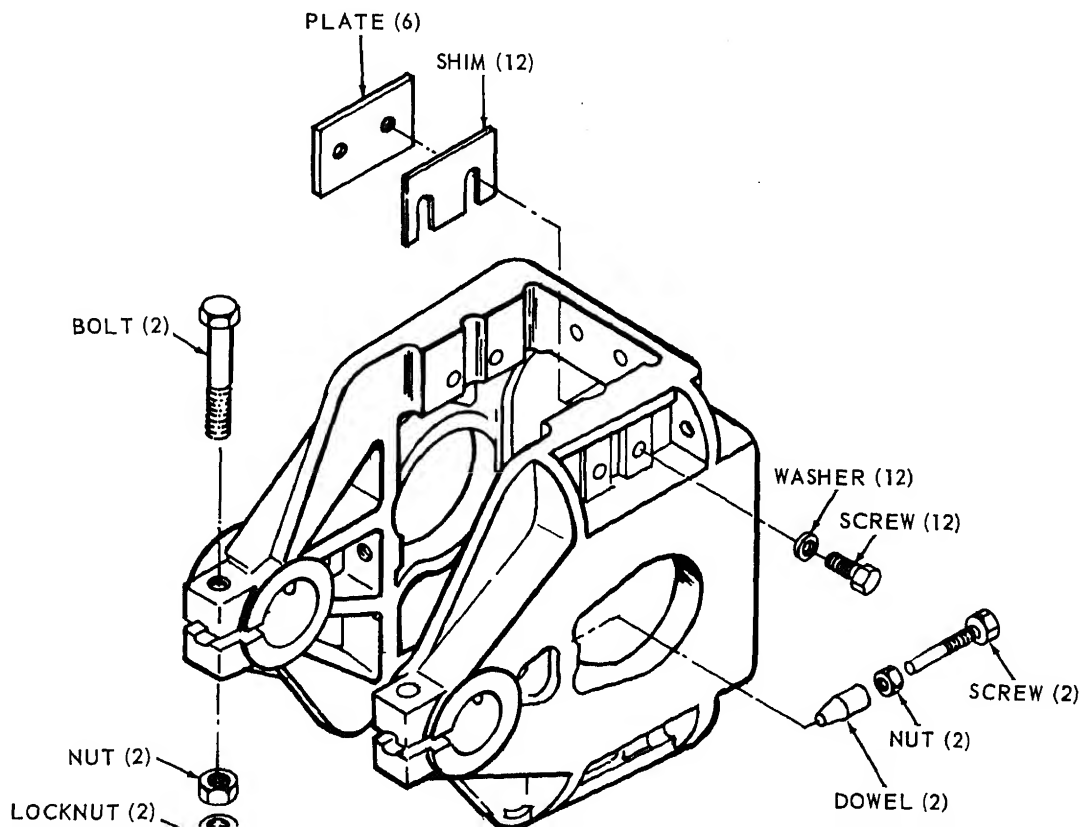
c. Disassembly. Refer to figure 4-58 and disassemble saddle block.

(2) Check wearing plates for proper clearance. Adjust if necessary.

e. Reassembly. Refer to figure 4-58 and assemble saddle block.

f. Adjustment of Saddle Block Wearing Plates. Refer to paragraph 2-8a(13).

g. Installation. Installation procedure is reverse of removal, *b*, above.



-73. Shovel Boom

a. General. The shovel boom is attached at the base to the superstructure turntable. It supports the dipper and handle assemblies. The outer end of the boom is supported by the boom hoist cables. The shovel boom consists of the boom weldment, cable sheaves, guards, bushings, and shafts.

b. Removal.

(1) Remove boom assembly, dipper, and handle (para 4-69a).

(2) Remove dipper handle and dipper assembly (para 4-71).

(3) Remove saddle block and shipper shaft (para 4-72).

c. Cleaning, Inspection and Repair. Clean and inspect parts for wear and damage. Replace worn or damaged parts.

d. Installation. Installation procedure is reverse of removal, *b*, above. Refer to paragraph 2-8 for adjustments.

Section XVIII. MAINTENANCE OF BACKHOE FRONT END EQUIPMENT

-74. General

a. This section contains instructions for replacing the backhoe front end equipment and for maintenance of components. For front end conversion to a backhoe, refer to paragraph 2-7.

b. Refer to paragraph 1-4e for description of the backhoe front end equipment.

c. Use a crane or other adequate lifting device for removing and installing components.

-75. Replacement of Backhoe Front End Equipment

a. Removal.

(1) Lower boom on support cribbing (fig. 2-15).

(2) Remove backhoe dipper and boom suspension cables (fig. 2-16).

(3) Remove boom foot locking bolts and nuts.

(4) Propel machine slowly backward until boom foot is separated from lugs on revolving frame.

b. Cleaning, Inspection and Repair.

(1) Clean and inspect boom assembly, dipper, and handle, for damaged or missing parts. Lubricate in accordance with current lubrication order.

(2) Repair or replace damaged or defective components.

The dipper is attached to the handle and pitch brace assembly. It is actuated by the pull cable through the padlock sheave assembly.

b. Removal.

(1) Lower dipper to rest on blocks, then remove drag cable from padlock sheave.

(2) Remove cotter pins and washers from handle and pitch brace pins. Remove handle and pitch brace pins, and remove dipper and padlock from handle.

c. Disassembly. Refer to figure 4-59 and disassemble dipper.

d. Cleaning, Inspection and Repair.

(1) Clean and inspect parts and attaching hardware for damage and wear.

(2) Inspect teeth and side cutters for wear and damage.

(3) Inspect padlock assembly for worn or damaged links, broken pins, and missing parts. Inspect sheave and bushing for wear and damage.

(4) Repair or replace damaged, worn, or missing parts.

e. Reassembly. Refer to figure 4-59 and reassemble dipper.

f. Installation. Installation procedure is reverse of removal, *b*, above.

4-77. Backhoe Handle and Back Brace

a. Removal.

4-79. Backhoe Boom

a. Removal.

(1) Remove backhoe front end equipment (para 4-75a).

(2) Remove dipper (para 4-76), handle (para 4-77), and auxiliary A-frame (para 4-78).

b. *Disassembly and Reassembly.* Refer to figure 4-62 for disassembly and reassembly of backhoe boom assembly.

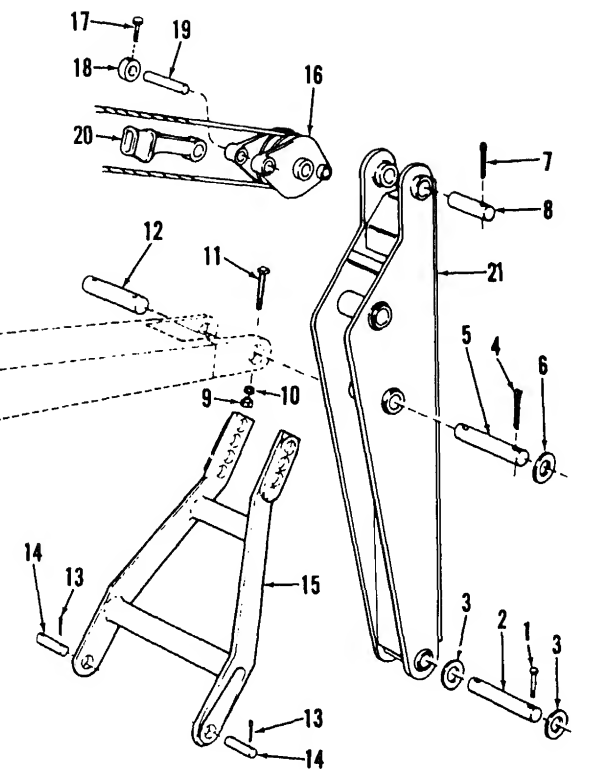
c. Cleaning, Inspection and Repair.

(1) Clean parts with an approved cleaning solvent.

(2) Inspect boom, sheaves, and bushings for wear and damage. Replace worn or damaged parts.

(3) Lubricate boom assembly in accordance with current lubrication chart.

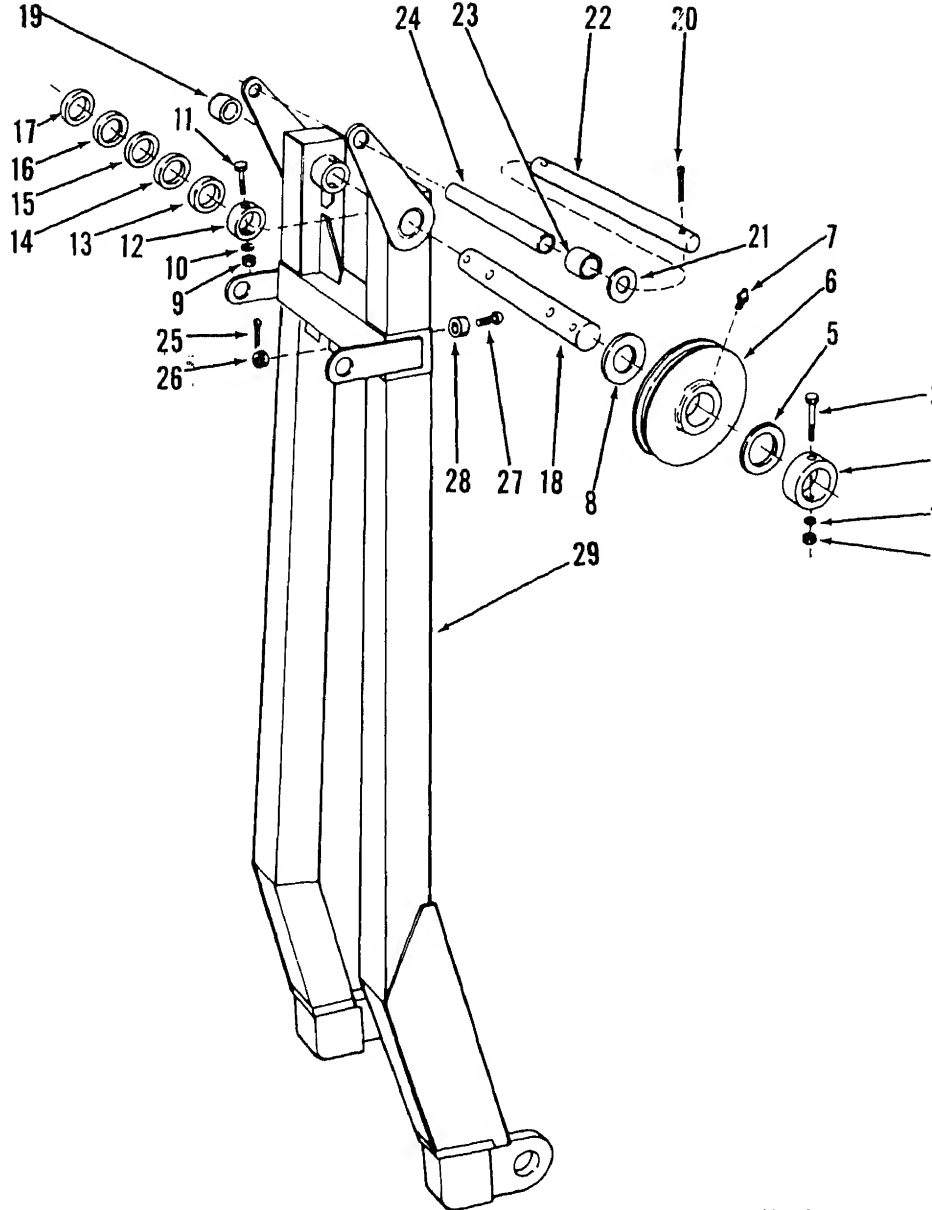
d. *Installation.* Installation procedure is reverse of removal, a, above.



ME 3810-289-12/4-60

Pin, cotter	11 Bolt (2)
Pin	12 Pin
Washer, flat (2)	13 Pin, cotter
Pin, cotter	14 Pin
Pin	15 Pitch brace
Washer, flat	16 Pulley and block assembly
Pin, cotter	17 Bolt
Pin	18 Collar
Nut (2)	19 Pin
Washer, lock (2)	20 Socket, cable

Figure 4-60. Backhoe handle and pitch brace assembly, exploded view

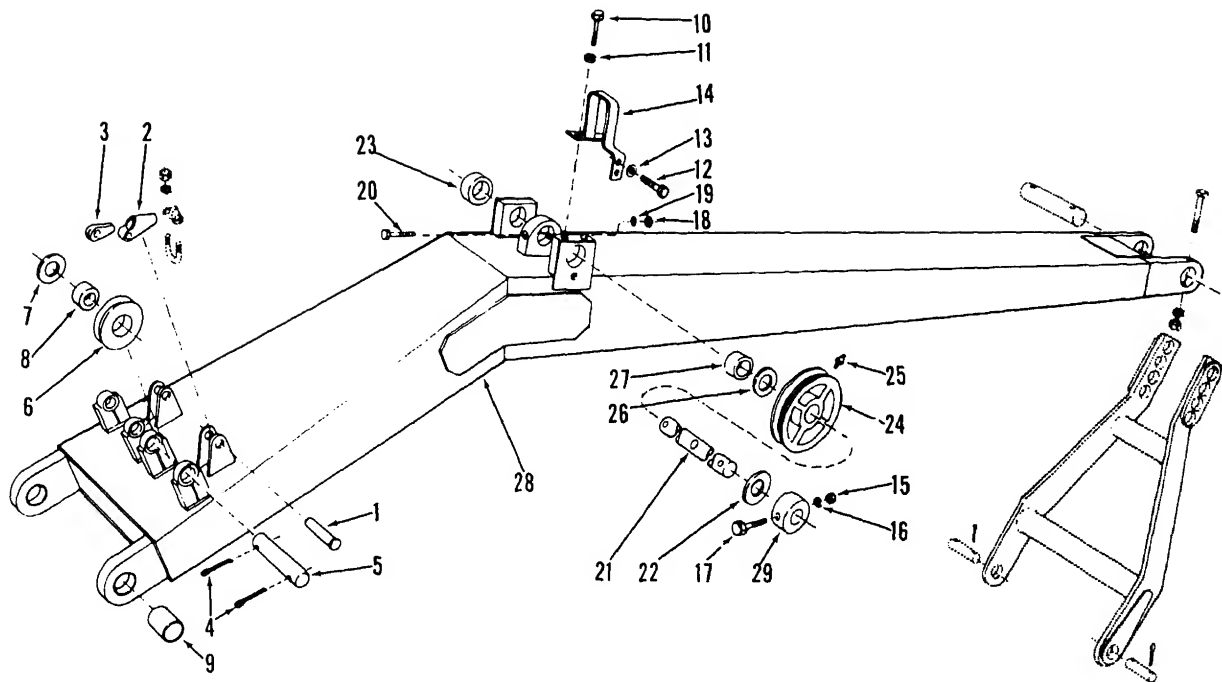


ME 3810-289-12/

- 1 Nut
- 2 Washer, lock
- 3 Bolt
- 4 Collar
- 5 Washer, flat
- 6 Sheave (4)
- 7 Fitting, lubrication
- 8 Washer, flat
- 9 Nut
- 10 Washer, lock

- 11 Bolt
- 12 Collar
- 13 Spacer
- 14 Spacer
- 15 Spacer
- 16 Spacer
- 17 Spacer
- 18 Shaft
- 19 Bushing
- 20 Pin, cotter

- 21 Washer, flat
- 22 Shaft
- 23 Spacer, pipe
- 24 Spacer, pipe
- 25 Pin, cotter (2)
- 26 Nut (2)
- 27 Bolt (2)
- 28 Bumper (2)



ME 3810-289-12/4-62

- | | | |
|-----------------|-----------------|-------------------------|
| 1 Pin | 11 Washer, lock | 21 Shaft |
| 2 Socket, cable | 12 Screw, cap | 22 Washer, flat |
| 3 Wedge, cable | 13 Washer, lock | 23 Collar |
| 4 Pin (2) | 14 Guard, cable | 24 Sheave |
| 5 Pin | 15 Nut | 25 Fitting, lubrication |
| 6 Sheave roller | 16 Washer, lock | 26 Washer, flat |
| 7 Washer, flat | 17 Bolt | 27 Bushing |
| 8 Bushing | 18 Nut | 28 Boom |
| 9 Bushing | 19 Washer, lock | 29 Collar |
| 0 Screw, cap | 20 Bolt | |

Figure 4-62. Backhoe boom assembly, exploded view.

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10

Hand Portable Fire Extinguishers for Arm
Users

A-2. Lubrication

C9100-1L

Fuels, Lubricants, Oils and Waxes

LO 5-3810-289-12

Lubrication Order, for Crane-Shovel, Crawl
Mtd, 12½-Ton Capacity, ¾-Cu Yd, Bucyrus
Erie Model 22BM

A-3. Maintenance

TB 750-651

Use of Antifreeze Solutions and Cleaning Com
pounds in Engine Cooling Systems

TM 38-750

Army Equipment Record Procedures

TM 5-3810-289-20P

Organizational Maintenance, Repair Parts and
Special Tool List for Crane-Shovel, Crawl
Mounted, 12½-Ton Capacity, ¾-Cu Yd, Bucyrus-Erie Model 22BM

TM 5-331B

Lifting, Loading and Hauling Equipment

TM 9-6140-200-15

Operator and Organizational, Field and Dep
Maintenance Storage Batteries, Lead-Ac
Type

TM 5-764

Electric Motor and Generator Repair

TB 385-101

Safety Use of Cranes, Crane-Shovel, Dragline
and Similar Equipment Near Electric Pow
Lines

A-4. Painting

TM 9-213

Painting Instructions for Field Use

A-5. Radio Suppression

TM 11-483

Radio Interference Suppression

A-6. Shipment and Storage

TM 740-90-1

Administrative Storage of Equipment

A-7. Destruction of Materiel

MAINTENANCE ALLOCATION CHART

Section 1. INTRODUCTION

-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or components will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

-2. Explanation of Columns in Section II

a. *Group Number, Column (1)*. The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes are listed on the MAC (Maintenance Allocation Chart) in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. *Functional Group, Column (2)*. This column contains a brief description of the components of each functional group.

c. *Maintenance Functions, Column (3)*. This column lists the various maintenance functions (A through K) and indicates the lowest maintenance level authorized to perform these functions. The symbol designations for the various maintenance levels are as follows:

- C—Operator or crew
- O—Organizational maintenance
- F—Direct support maintenance

B—Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C—Service. To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.

D—Adjust. To rectify to the extent necessary to bring into proper operating range.

E—Align. To adjust specified variable element of an item to bring to optimum performance.

F—Calibrate. To determine the corrections to be made in the readings of instruments of test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G—Install. To set up for use in an operational environment such as an emplacement, site, or vehicle.

H—Replace. To replace unserviceable item with serviceable assemblies, subassemblies or parts.

I—Repair. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

J—Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only

repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

d. Tools and Equipment, Column (4). This column is provided for referencing by code the special tools and test equipment (sec III) required to perform the maintenance functions (sec V).

e. Remarks, Column (5). This column is provided for referencing by code the remarks (sec V) pertinent to the maintenance functions.

-3. Explanation of Columns in Section III

a. Reference Code. This column consists of a number and a letter separated by a dash. The number references the T&TE requirements column on the MAC. The letter represents the specific maintenance function the item is to be

used with. The letter is representative of column A through K on the MAC.

b. Maintenance Level. This column shows the lowest level of maintenance authorized to use a special tool or test equipment.

c. Nomenclature. This column lists the name or identification of the tool or test equipment.

d. Tool Number. This column lists the manufacturer's code and part number, or Federal stock number of tools and test equipment.

B-4. Explanation of Columns in Section IV

a. Reference Code. This column consists of two letters separated by a dash, both of which are references to section II. The first letter references column (5) and the second letter references maintenance function, column (3), A through K.

b. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, section II.

Section II. MAINTENANCE ALLOCATION CHART

(2)	(3) Maintenance functions										(4) Tools and equipment	(5) Remarks
	A	B	C	D	E	F	G	H	I	J	K	
	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	
1 group Assembly ----- Blk, Cyl Head; Cylinders, Pistons, base ----- Cylinder ----- Piston ----- Crankshaft Assembly; Crankshaft ----- and pulley ----- Assembly: ----- Connecting Rods: ----- Crankshafts and ----- Pistons: ----- Assembly rocker ----- Pistons, camshaft, ----- Piston valve ----- Pistons, springs, ----- Pistons, locks, valves ----- Piston seats ----- Piston lubrication ----- oil ----- Assembly, oil ----- Piston, oil ----- oil ----- Pistonpass ----- Driving ----- Piston ----- Assembly -----	C	F	C	--	--	F	--	F	F	H	D	A
	--	--	--	--	--	--	--	F	F	F		
	--	--	--	--	--	--	--	H	--	H	D	B
	F	--	--	--	--	--	--	F	F	H		
	--	--	--	--	--	--	--	H	H			
	--	--	--	O	--	--	--	H	H	--	--	
	H	--	--	--	--	--	--	H	O			
	--	--	--	--	--	--	--	H	H			
	O	--	--	--	--	--	--	O	O			
	--	--	C	--	--	--	--	O	O			
	F	--	--	--	--	--	--	F	H	D		
	--	--	--	--	--	--	--	O	O			
	O	--	--	--	--	--	--	O	O			
	--	--	--	--	--	--	--	F	F			
	F	--	--	--	--	--	--	F	F			
	C	--	--	--	--	--	--	F	F			

Item Description	QTY	UNIT	PRICE	AMOUNT	TAX	TOTAL	REMARKS
Panel: _____	0						
_____ ; gages;							
_____ panel	0						
_____ fuses							
_____ mess _____							
_____	0						
_____ odlight _____	0						
_____ s and _____	0						
_____ wiches _____	0						

_____ rage:							
_____ y, cables,	C	0					
_____	C						
_____ ing Harness _____							
_____ r Supp _____	0						
_____ ON							
_____ Assembly,	C						
_____ D TRACKS							
_____ Assembly _____	0						
_____ t Rollers	C						
_____	C						
_____ & Brackets _____	C						
_____ Sprockets:	F						
_____ er _____	C						
_____ bly _____							
_____	0						
_____ ts _____							
_____ :							
_____ des, glass,	C						
_____ tforms _____							
_____ eats & Carpets:							
_____ bly _____							
_____ VELS &							
_____ VING EQ							
_____ UNTS							
_____ Attachment:							
_____ ably _____							
_____ k assembly _____							
_____ bly _____							

Section II. MAINTENANCE ALLOCATION CHART

[illegible]

entry -----	--	--	C	--	--	--	--	--	O					
oller, shaft --	--	--	C	--	--	--	--	--	O					
sembly -----	--	--	C	--	--	--	--	--	O					
, Frame &														
track -----	C	--	--	--	--	--	--	--	H	D				
r, bearings --	H	--	--	--	--	--	--	--	H					
Steering														
n Bearings,														
Seals -----	F	--	--	--	--	--	--	--	F					
NG EQUIP-														
uishers -----	C	--	--	--	--	--	--	--	C					

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

Reference Code	Maintenance level	Nomenclature	Tool numb
1-D	0	Wrench adapter	ST-6
2-D	0	Belt tension gage	ST-9

Section IV. REMARKS

Reference code	Remarks
A-F	Test includes engine operation and compression.
B-J	Metalize, grind and resize.
C-B	Test includes bench test.
D-H	Replace filter element.
E-I	Install repair kit.

BASIC ISSUE ITEMS LIST

C-1. Scope

C-2. General

b. Maintenance and Operating Supplies—Section III. A listing of maintenance and operating supplies required for initial operation.

E-3. Explanation of Columns

a. Source, Maintenance, and Recoverability Codes (SMR).

(1) Source code indicates the source for the
sted item. Source code is:

Code	Explanation
P	Repair parts which are stocked in or supplied from the GSA/DSA or Army supply system, and authorized for use at indicated maintenance levels.

(2) Maintenance code indicates the lowest level of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Operator/crew

(3) Recoverability code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable.

Code	Explanation
	repair parts may be listed for automatic return to supply for depot level repair set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.

b. *Federal Stock Number.* This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e", when used as a part of the nomenclature, indicates that the Federal stock number includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parentheses. Repair parts quantities included in kits, sets, and assemblies, are shown in front of the repair part name.

d. *Unit of Measure (U/M)*. A two-character alphabetic abbreviation indicating the amount

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration in which the item is shown.

(2) *Item number.* Indicates the callout number used to reference the item in the illustration.

-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies—Section III

a. Component Application. This column identifies the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for 8 Hours' Operation. This column indicates the estimated quantity required for an average 8 hours of operation.

f. Notes. This column indicates information notes keyed to data appearing in a preceding column.

Section II. BASIC ISSUE ITEMS

(1) SMR Code	(2) Federal stock number	(3) Description	(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with equip	(7) Illustration	
						(a) Fig. No.	(b) Item No.
PC	7510-889-3494	BINDER, Looseleaf	ea		1		
PC	7520-559-9618	CASE, Maintenance and Operation Manuals	ea		1		
PC	2590-045-9611	CASE Rifle	ea		1		
		DA LUBRICATION ORDER LO 5-3810-289-12	ea		1		
		DA TECHNICAL MANUAL TM 5-3810-289-12	ea		1		
PC	4210-889-2221	EXTINGUISHER, Fire, 2½ lb Fed Spec O-E95	ea		1		

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required f/initial operation	(5) quantity required f/8 hrs. operation	(6) Notes
CASE	9150-265-9435 (2) 9150-265-9428 (2) 9150-242-7603 (2)	OIL, LUBRICATING: 5-gal drum as follows: OE 30 OE 10 OES	3 qt 3 qt 3 qt	(3) (3) (3)	(1) Includes quantity of engine oil system 20-qt crankcase w/ 20-qt oil can (2) See C9100-IL for data and requirements.
CASE	9150-265-9435 (2) 9150-265-9428 (2) 9150-242-7603 (2)	OIL, LUBRICATING: 5-gal drum as follows: OE 30 OE 10 OES	20 qt 20 qt 20 qt	(3) (3) (3)	(3) See current LO plication and replacment intervals.
ASE, MAIN	9150-577-5844 (2) 9150-259-5440 (2)	OIL, LUBRICATING, GEAR: 5-gal drum as follows: GO 90 GOS	32 qt 32 qt	(3) (3)	(4) Average fuel consumption 2.3 gal per hour of operation. (5) Maximum protected at 60 percent (4.8 pt per gal of fuel)
ASE, WTLR	9150-577-5844 (2) 9150-254-5440 (2)	OIL, LUBRICATING, GEAR: 5-gal drum as follows: GO 90 GOS	2 qt 2 qt	(3) (3)	
EXPOSED	9150-234-5199 (2)	OIL, LUBRICATING, EXPOSED GEAR: 5-gal can as follows: CW-11-B	5 lb	(3)	
E POINTS	9150-190-0905	GREASE, AUTOMOTIVE AND ARTILLERY: 5-lb can as follows: GAA	5 lb	(3)	
N POINTS	9150-265-9435 (2) 9150-265-9428 (2) 9150-242-7603 (2)	OIL, LUBRICATING: 5-gal drum as follows: OE 30 OE 10 OES	1 qt 1 qt 1 qt	(3) (3) (3)	
TOR	6850-664-1403	WATER ANTIFREEZE: 1-gal can as follows: Ethylene-glycol ANTIFREEZE: 55-gal drum as follows:	28 qt 18 qt	(5)	

6850-174-1806	Antifreeze, arctic	28 qt	
9150-577-5844 (2)	OIL, LUBRICATING, GEAR: 5-gal drum as follows: GO 90	4 qt	(3)
9140-286-5294 (2) 9140-286-5286 (2) 9140-286-5283 (2)	FUEL, DIESEL: Bulk as follows: DF-2 Regular DF-1 Winter DF-A Arctic	50 gal 50 gal 50 gal	(4) (4) (4)

INDEX

	Paragraph	Page		Paragraph	Page
A					
Adjustment:			Chain case assembly	4-65	4-7
Alternator belt	3-17	3-16	Chain case service	3-32	3-3
Boom hoist brakeband	3-30	3-24	Clamshell bucket	4-60	4-6
Boom hoist clutch bands	3-29	3-24	Clutch assembly	3-10, 4-16	3-1
Clutch assembly	4-16	4-7	Clutches, operating	3-27	4-1
Control levers	3-11	3-7	Components, oil cooler	4-14	3-2
Covers, frame	4-67	4-71	Cone roller replacement and repair	4-66	4-7
Fan belt	3-16	3-15	Cone roller service	3-34	3-3
Operating clutches	3-27	3-24	Control levers	3-11, 4-17	3-1
Rocker arm assembly	4-13	4-7	Controls and instruments	2-13	4-1
Seat assembly	3-24	3-22	General	2-12	2-3
Steering clutch	3-28	3-24	Counterweight	2-3	2-5
Swing lock	3-12	3-7	Crane boom assembly	3-26, 4-56	3-2
Track assembly	3-22	3-18	Crane boom suspension cable	4-54	4-1
Track rollers	3-20	3-18	Crane hoist cable	4-55	4-1
Wiper cleaner:			D		
Replacement	4-22	4-12	Description	1-4	1-1
Service	3-13	3-12	Detailed lubrication information	3-4	3-1
Wiper intake manifold	4-28	4-22	Difference in models	1-6	1-6
Alternator assembly	3-17, 4-35	3-16, 4-32	Digging lock inspection and service	3-31	3-3
Alternator belts	3-17, 4-36	3-16, 4-32	Dismantling and movement	2-10	2-2
			Dragline bucket	4-58	4-6
			Dragline fairlead	4-59	4-6
B			E		
Backhoe:			Engine safety control	4-39	4-1
Auxiliary A-frame	4-78	4-80	Equipment conversions	2-4	2-1
Boom assembly	4-79	4-81	Errors, reporting of	1-3	1-1
Dipper and padlock	4-76	4-79	Exhaust manifold	4-30	4-1
Front end replacement	4-75	4-79	F		
Handle and back brace	4-77	4-79	Fan belts:		
Basic issue items:			Inspection and service	3-16	3-1
Maintenance and operating supplies	3-2	3-1	Removal and installation	4-32	4-1
Tools and equipment	3-1	3-1	Fan blade	4-34	4-1
Battery and battery cables	4-46	4-42	Fire extinguisher	2-17	2-1
Boom angle indicator	2-3	2-5	Floodlights	4-43	4-1
Boom assembly:			Forms and records, maintenance	1-2	1-1
Backhoe	4-79	4-81	Frame covers	4-69	4-1
Crane	3-26, 4-56	3-24, 4-55	Front end conversion:		
Shovel	4-73	4-79	Backhoe	2-7	2-1
Boom hoist brakebands:			Clamshell	2-6	2-1
Adjustment	3-30	3-24	Dragline	2-5	2-1
Replacement	4-64	4-68	Piledriver	2-9	2-1
Boom hoist clutch bands:			Shovel	2-8	2-1
Adjustment	3-29	3-24	Fuel filters, service and replacement	4-23	4-1
Replacement	4-63	4-68	Fuel lines, fittings, shutoff valve	4-23	4-1
Boom, jib	4-61	4-63	Fuel pump	4-19	4-1
Boom suspension cable, crane	4-54	4-53	Fuel tank and cap strainer service	3-14	3-1
Bucket and teeth replacement:			Fuel tank inspection and replacement	4-27	4-1
Clamshell	4-60	4-61			

	Paragraph	Page		Paragraph
Horn replacement -----	4-44	4-39	Alternator belt -----	4-36
I			Cab assembly -----	4-51
Identification and tabulated data ----	1-5	1-4	Chain case assembly -----	4-65
Inspecting and servicing equipment ---	2-1	2-1	Cone roller -----	4-66
Installation of separately packed			Engine safety control -----	4-39
components -----	2-2	2-1	Exhaust manifold -----	4-30
Installation or setting-up instructions -	2-3	2-5	Fan belt -----	4-32
J			Fan blade -----	4-34
Jib boom -----	2-2,	2-1,	Floodlights -----	4-43
	4-61	4-63	Fuel filters -----	4-23
L			Horn -----	4-44
Lamp replacement -----	4-43	4-39	Lamp -----	4-43
Lubrication information:			Mufflers and pipes -----	4-29
Detailed -----	3-4	3-1	Radiator -----	4-31
General -----	3-3	3-1	Safety boom stop -----	4-57
M			Seat assembly -----	4-52
Maintenance and operating supplies --	3-2	3-1	Solenoid -----	4-38
Maintenance forms and records -----	1-2	1-1	Switches, gages and meters -----	4-40
Maintenance repair parts -----	4-3	4-1	Throttle control -----	4-25
Meters, gages, and switches			Track roller chain -----	4-49
replacement -----	4-40	4-39	Track support rollers and brackets ...	4-48
Muffler and pipes replacement -----	4-29	4-22	Reporting of errors -----	1-3
O			Rocker arm adjustment -----	4-13
Oil cooler -----	4-14	4-7	S	
Oil filter assembly -----	4-15	4-7	Safety boom stop, replacement	
Operating clutch band, removal			and repair -----	4-57
and installation -----	3-27	3-24	Scope -----	1-1
Operating clutches adjustment -----	4-62	4-68	Seat assembly adjustment -----	3-24
Operation under unusual conditions:			Seat assembly replacement and repair -	4-52
Extreme cold -----	2-23	2-58	Service:	
Extreme heat -----	2-24	2-58	Air cleaner -----	3-13
High altitudes -----	2-27	2-59	Center gudgeon bushing -----	3-33
Mud or soft terrain -----	2-25	2-58	Chain case assembly -----	3-32
Salt-water areas -----	2-26	2-59	Cone roller -----	3-34
Operation under usual conditions:			Crane boom assembly -----	3-26
General -----	2-14	2-39	Digging lock -----	3-31
Operation of backhoe -----	2-20	2-53	Fuel filters -----	4-23
Operation of clamshell -----	2-19	2-53	Fuel tank and cap strainer -----	3-14
Operation of crane -----	2-17	2-39	Hoist assemblies -----	3-36
Operation of dragline -----	2-18	2-39	Radiator -----	3-15
Operation of piledriver -----	2-22	2-55	Starting motor -----	3-8
Operation of shovel -----	2-21	2-55	Vertical and horizontal swing and	
Starting -----	2-15	2-39	propel shafts -----	3-35
Stopping -----	2-16	2-39	Shaft service:	
P			Horizontal propel -----	3-35
Panel light -----	4-45	4-39	Horizontal swing -----	3-35
Piledriver -----	2-9,	2-20,	Vertical propel -----	3-35
	2-22,	2-55,	Vertical swing -----	3-35
	3-37	3-30	Shovel:	
Preventive maintenance:			Boom assembly -----	4-73
Checks and services -----	3-6, 4-5	3-3, 4-1	Dipper -----	4-70
General -----	3-5, 4-4	3-3, 4-1	Handle -----	4-71
Primer assembly replacement -----	4-24	4-12	Saddle block -----	4-72
			Shipper shaft -----	4-72
			Shutdown valve:	

pping -----	2-10	2-28
ing lock:		
Adjustment -----	3-12	3-7
Removal and replacement -----	4-18	4-10
itches, gages and meters,		
replacement -----	4-40	4-39
T		
culated data -----	1-5	1-4
nk cap strainer:		
Replacement -----	4-26	4-12
Service -----	3-14	3-12
sting:		
Alternator assembly -----	4-35	4-32
Battery -----	4-46	4-42
Solenoid -----	4-38	4-37
Starter motor -----	4-37	4-32
ermostat and thermostat housing --	4-33	4-26
rottle control replacement -----	4-25	4-12
ols and equipment -----	3-1, 4-1	3-1, 4-1
ack assembly:		
Adjustment -----	3-22	3-18

Repair -----	4-50	4-4
Track brackets:		
Replacement and repair -----	4-48	4-4
Service -----	3-20, 3-21	3-18
Track idlers and brackets:		
Service -----	3-21	3-18
Track roller chain -----	4-49	4-4
Track support rollers and brackets --	3-20	3-18
Transmission shaft assembly -----	3-19,	3-18
	4-47	4-4
Troubleshooting:		
General -----	3-7, 4-6	3-6, 4-7
Troubleshooting chart -----	3-8, 4-7	3-6, 4-7
V		
Valve cover replacement -----	4-12	4-3
Vertical and horizontal swing and		
propel shafts service -----	3-35	3-30
W		
Wiring harness repair -----	4-42	4-38

By Order of the Secretary of the Army:

W. C. WESTMORELA
*General, United States
Chief of Staff.*

Official:

KENNETH G. WICKHAM,
*Major General, United States Army,
The Adjutant General.*

Distribution:

To be distributed in accordance with DA Form 12-25, Section II (qty rqr block No. 341) for maintenance requirements for Crane-Shovels, Crawlers, 12½ Ton.

